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SOME ECOLOGICAL OBSERVATIONS ON BRYOPHYTES

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I. PECTIN CONTENT OF CERTAIN BRYOPHYTES

Roberts and Haring (1937), in a study particularly of *Fontinalis gigantea, Cirriphyllum Boscii* and *Polytrichum commune*, determined by microchemical methods the various chemical constituents of the cell wall. They concluded that the amount of pectic compounds is correlated with water intake, and that the degree of cutinization and suberization is correlated with water retention. The relative amounts of these substances then determine the ecological distribution of these mosses. The leaves of the mosses studied were not cutinized or suberized except for the middle lamella of the cell walls of *Fontinalis* and in the basal cells of the leaves in *Polytrichum*. The question arises as to the effectiveness of the water-retention mechanism versus the presence of uncutinized leaves as regions of water loss. Further, air-dry samples of more extreme xerophytes than those studied by Roberts and Haring as *Grimmia, Ulota, Orthotrichum*, and *Hedwigia*, absorb liquid water and become turgid with remarkable speed, indicating lack of protective cutinization at least in the leaves. The converse seems safe to assume, that effective retardation of water loss by a cuticle during periods of evaporational stress likewise plays a negligible rôle. Vaizey (1887) found no trace of cuticularization in the external walls of the gametophyte, and Czapek (1899) found no "besondere Schutzstoffe" in leaves, as a rule. Kressin (1935) was not able to detect a cuticle in the several forms under investigation. The question arises as to whether there may be another substance within the bryophytes that absorbs and holds water to the extent of determining their ecological distribution. As Roberts and Haring find pectin present in variable amounts in bryophytes, it was thought that

further study of the pectin content of bryophytes might reveal a possible rôle in their ecological distribution.

The writer, in previous studies (1940a, b), has analyzed by ecological methods the relative degree of dependence upon moisture of the dominant bryophytes on boulders and tree trunks at Mountain Lake, Virginia. Thus, two series of bryophytes are known in regard to their order of dependence upon moisture. This seems to offer good material for determining, first, whether significant differences in pectin content exist and, second, whether they are correlated with types of habitat. Three members of the boulder succession and four of the corticolous series were used. In addition, to complete these two series, the deeply mesic soil moss, *Catharinea undulata*, and the hydric *Fontinalis dalecarlica* were added.

The method of extraction of pectic compounds followed was similar to usual methods as described by Loomis and Shull (1937). The specific method used in these determinations was kindly given to the writer in a personal communication by Dr. Emmett Bennett, Department of Chemistry of the Massachusetts State College.

Samples of bryophytes were obtained by clipping off the living leafy tips of the bryophytes, picking them free of detritus, and thoroughly washing them free from detectable grit. They were then rinsed in distilled water and blotted with a clean, lintless towel. The collection and cleaning of the bryophytes for all of the following experiments were done in this manner. The bryophytes for this experiment were dried first at room temperature, then overnight in an oven at 105° C. The weight of the samples varied between approximately 1.5 and 3.0 grams oven dry weight, except for one sample slightly under one gram. After weighing, the samples were treated for 24 hours with 95% ethyl alcohol in a Soxhlet extractor. A few extractions were made with absolute alcohol for 12 hours, then 80% alcohol for 12 hours, but no apparent difference as a result of the two procedures was noted.

The bryophytes were either ground to a fine powder or merely chopped into small pieces before oven drying and extraction were commenced, but there was no noticeable increase of pectic compounds at the end of the experiment as a result of grinding the sample.

After drying the Soxhlet-extracted sample until free of alcohol, the pectic compounds were extracted in 0.6% ammonium citrate in water kept at 75° C. for 40 hours. Four to five changes of the citrate solution

were made during the extraction. The solution containing the extracted pectins was made up to standard volume and 0.4% sodium hydroxide was added to an aliquot. After 12 hours, the sodium pectate was dissociated with normal acetic acid, and the pectins precipitated as calcium pectate with the addition of 11.1% calcium chloride. Calcium pectate was filtered off after the solution had stood for 12 hours, washed, dried, weighed and calculated as the percentage of the weight of the oven dry, unextracted sample.

Only a few milligrams of pectic compounds were extracted as calcium pectate. In the table below the percentages of pectic compounds as calcium pectate are expressed in terms of the dry weight of the unaltered bryophytes.

TABLE 1. Pectin contents

	% of calcium pectate
I. Boulder series	
a. Xeric	
Ulota americana	0.25
b. Intermediate	
Dicranum scoparium	0.54
c. Mesic	
Thuidium delicatulum	0.22
II. Corticolous series	
a. Xeric	
Ulota crispa	0.40
b. Intermediate	
Porella platyphylloidea	0.45
Leucodon brachypus	0.84
c. Mesic	
Anomodon attenuatus	0.61
III. Soil Mesic	
Catharinea undulata	2.26
IV. Hydric	
Fontinalis dalecarlica	0.62*

* Average of two tests.

The question of the extreme accuracy in the extraction and weighing of the near trace of material is not significant because of, first, the small quantities represented, and second, the lack of correlation of pectic compounds with the habitat. It was felt that the results were too insignificant to justify repeating the experiment several times to obtain a more accurate average figure for each sample. Examination of the leaves after extraction with ammonium citrate showed no noticeable alteration of the cell walls.

It would seem from the above that pectic compounds extractable by the above procedure are present in minute quantities, and the variations noted are not correlated with the degree of xerophytism of the respective usual habitats of the bryophytes. The relatively large amount in *Catharinea* seems to be without apparent ecological significance.

II. Absorption of Atmospheric Moisture by Bryophytes

A. Extracted bryophytes. The question arose as to whether bryophytes from the different ecological habitats showed differential absorption of atmospheric moisture because of residual material unextracted from them. The bryophytes left from the preceding experiment were used. To this series was added extracted *Gyrophora Dillenii*, one of the dominant foliose lichens just preceding the bryophytic stages in point of xerophytism in the boulder succession (Patterson, 1940a). The extractions in the above experiment not only removed the pectic compounds, but all or virtually all water and alcohol-soluble constituents of the plants.

The extracted bryophytes in equilibrium with the moisture content of the laboratory air were placed in weighing tubes and put in a calcium chloride desiccator for 11 days when periodic weighings showed equilibrium was attained or virtually so. The samples were then weighed and placed in a desiccator type dish with monobasic ammonium phosphate in solution with excess of the solid phase. According to Spencer (1926) the confined air above such a solution at 20° C. has a humidity of 93.1% and at 25° C., 93.0%. The experiment was run in a laboratory where the temperature fluctuations fell within these temperature limits. After 11 days, when weighings indicated that equilibrium was attained or virtually so, the material was oven dried at 105° C. and reweighed. The moisture contents of the bryophytes over calcium chloride and at 93% humidity were determined on the basis of the oven dry weights of the extracted samples. The percentages are shown in Table 2, where members of the boulder and corticolous series are listed in the order of their dependence upon moisture. *Catharinea* and *Fontinalis* are again added to complete the ecological series.

It will be noted that there is some variability in the calcium chloride chamber, but relatively less at the high humidity. All absorb much more moisture than a sample of filter paper carried along as check.

TABLE 2. Moisture absorbed from the air by pectin-free bryophytes

	Moisture content over calcium chloride	Moisture content at 93% humidity
I. Boulder series		
a. Xeric		
Gyrophora Dillenii	5.48	31.07
Ulota americana	3.25	32.07
b. Intermediate		
Dicranum scoparium	4.01	31.24
c. Mesic		
Thuidium delicatulum	3.71	35.06
II. Corticolous series		
a. Xeric		
Ulota crispa	4.34	33.74
Porella platyphylloidea	2.94	34.66
b. Intermediate		
Leucodon brachypus	5.46	33.50
c. Mesic		
Anomodon attenuatus	5.16	33.38
III. Soil Mesic		
Catharinea undulata	3.62	34.88
IV. Hydric		
Fontinalis dalecarlica	2.93	29.63
V. Control		
Filter paper	1.29	14.38

The interesting point is that there is no apparent correlation of absorption capacity with ecological habitat.

B. Fresh bryophytes. The absorption of atmospheric moisture by bryophytes is a well-known phenomenon. Mayer and Plantefol (1927) and Renner (1933) recognize that there is a relationship between humidity and water content of bryophytes. No one, however, to the writer's knowledge, has determined whether there is a differential adaptation for water absorption from the air in a xeric-hydric series.

Bryophytes were collected, cleaned and air dried in the laboratory just prior to or a few days before use. Moderate sized samples whose dry weights ranged between approximately 0.9–2.0 grams were used.

Two experiments were carried out with fresh, living bryophytes. In the first, the bryophytes were packed in weighing tubes and placed in a desiccator over dry calcium chloride for two weeks until equilibrium had been obtained. The final weight of the bryophyte was noted and the material was transferred to 93% humidity.

There is danger of the mosses molding in the 93% humidity cham-

ber, and mold was noted on the tenth day in two specimens. All tubes were removed and weighed on the eleventh day. Some were apparently at equilibrium and from the flattened curves of water absorption the others were virtually at equilibrium. They were then oven dried at 105° C. for 24 hours, reweighed and the percentage of moisture in terms of dry weight of the bryophytes calculated for the calcium chloride degree of desiccation and that of the 93% chamber.

In a second experiment fresh samples of all but three of the bryophytes used above were prepared as described above, dried over calcium chloride, then exposed to 43–44% and 71–72% humidities. Potassium carbonate with excess of solid phase was used for the 43–44% humidity. According to Spencer (1926), the confined air above this solution has 44% humidity at 18.5° C., and 43% at 24.5° C. Similarly, ammonium chloride and potassium nitrate in solution with an excess of the solid phase of both salts give 71.6% humidity at 20° C. and 71.2% at 25° C. The bryophytes were left at each humidity level for 17 days during which equilibrium was attained. They were weighed immediately after removal from each chamber. The temperature remained within the above indicated ranges during the experiment.

After terminal drying as above, the moisture content of these intermediate humidities was determined and expressed in percentages of the oven-dry weights of the samples. Below are given the absorptive values of the series of bryophytes tested, listed in their ecological order. *Gyrophora, Catharinea* and *Fontinalis* are included again.

If the xeric bryophytes survive their habitat by a greater propensity for absorbing moisture from the air, a marked differential would be expected between the forms at one extreme and those at the other. The different percentages are sufficiently uniform to obviate, apparently, the usefulness of repeating the experiments and averaging the results to obtain more accurate figures. The spread of ecological types is great enough to make the sample apparently a good one.

The variations in amount of moisture absorbed at various humidities are minor ones and may be due both to differences of material and to small experimental errors. There is no consistent difference between the absorptive capacity of the ecologically diverse bryophytes tested. Thus, there appears to be little or no correlation between the degree of xerophytism of the bryophytes investigated and their absorption of atmospheric moisture.

TABLE 3. Moisture absorbed from the air by fresh bryophytes

	Moisture contents			
	$CaCl_2$	43–44%	71–72%	93%
I. Boulder series				
a. Xeric				
Gyrophora Dillenii	4.38*	13.26	21.04	34.61
Ulota americana	3.74			32.28
b. Intermediate				
Dicranum scoparium	5.23*	12.99	20.06	37.53
c. Mesic				
Thuidium delicatulum	5.75*	13.29	19.87	39.61
II. Corticolous Series				
a. Xeric				
Ulota crispa	5.27*	13.95	21.27	38.1
Frullanea Asagrayana	9.21			44.14
b. Intermediate				
Porella platyphylloidea	4.12			48.75
Leucodon brachypus	5.00*	14.21	21.99	39.78
c. Mesic				
Anomodon attenuatus	6.17*	15.31	23.27	39.64
III. Soil Mesic				
Catharinea undulata	5.77*	11.71	18.44	38.10
IV. Hydric				
Fontinalis dalecarlica	4.01*	11.29	17.22	28.69

* Average of two experiments.

III. COMPARATIVE RESPIRATIONAL RATES OF CERTAIN BRYOPHYTES

This experiment attempts to determine, first, whether there is a real respirational difference between bryophytes; and, second, whether this difference is correlated with degrees of xerophytism of the normal habitats.

Stålfelt (1937) in a study of photosynthesis of six mosses has shown that in contrast to carbon dioxide assimilation, respiration is little affected by a previous drought period. There is apparently no diminution of respirational rate upon irrigation after short periods of drought. After 18–65 days of drought, the respirational increase after irrigation was very rapid, reaching its maximum in the first half hour and returning to normal in the next 2–4 hours. Mayer and Plantefol (1926) and Plantefol (1927) have shown the relationship between photosynthesis and respiration and the water content of *Hypnum triquetrum*. Both fall off sharply with decreased water content: photosynthesis reaching zero while respiration is still detectable. Freymouth (1928) also shows the dependence of respiration upon moisture in two ter-

restrial algae, a lichen, *Parmelia*, and the moss, *Hypnum cupressiforme*.

Preliminary experiments by the writer with six mosses at 71% humidity (about 20% moisture, see table 3), indicated excessively low respirational rates. Minute respirational differences during dormancy may give a clue to the differential ability of bryophytes to survive long periods of drought. These minute differences could not be detected by the titrimetric method used. On the other hand, respirational differences between xeric and mesic bryophytes may be more clearly reflected in normally turgid bryophytes. Freymouth (1928) found differences in the optimum respiration rates in the four forms noted above.

Using the respirational rates of normally turgid bryophytes as key to metabolic activity, the respirational rates of bryophytes of different ecological habitats were determined. Only the gametophytic generation of the bryophytes was used.

The bryophytes were collected with particular care to select fresh, normal, well-developed plants. Freymouth (1928) cites Bastit (1891) as showing great variation in respiration rates according to the age and history of the samples. After rinsing the cleaned samples with distilled water, the excess capillary water was blotted off with a clean, lintless towel. Both Freymouth and Stålfelt (1937) have pointed out that capillary water interferes with the rate of gaseous exchange. A bryophyte sample so treated was ready to be placed immediately in the respirational chamber. Only samples cleaned within 24 hours of collection were used for experimentation. The bryophytes were not exposed to any long drought periods (Stålfelt 1937).

The titrimetric method was used to determine carbon dioxide production. The CO_2-free air was passed through water before entering the light-tight respirational chamber to prevent drying the bryophytes. The air-flow was regulated to 50–60 bubbles per minute. The apparatus was set up in triplicate, a water column pressure regulator serving the three gas trains.

The amount of bryophyte used was rather large, about 3–8 grams at 110° C. oven dry weight, most of the samples weighing between 4 and 5 grams. The bryophytes were placed in the respirational chambers in a very loose condition to avoid any packing of the material. The experiments were run between 19–30 hours, mostly around 24. The temperature was uncontrolled, but varied little from

day to day. To make the respirational determinations of different experiments mutually comparable, a control bryophyte was run with each. The control selected was *Dicranum scoparium*, With each run, a fresh sample of *D. scoparium* was prepared from a single large colony.

Taking the amount of respirational activity of *D. scoparium* as an arbitrary constant, 100, the relative respirational rates of the other two bryophytes in the parallel gas trains were computed. This was done for each experiment. Since the proportionality of the other two bryophytes to *D. scoparium* was computed for each run, the proportionality of the respirational rates of all the bryophytes from the separate experiments, it is presumed, can be directly compared. This was done by comparing the amount of tenth normal barium hydroxide reacting with respirational carbon dioxide per hour per gram dry weight of the bryophyte. Bryophytes were selected to represent the various ecological types from xeric to hydric. In the table below, they are arranged in their order of dependence upon moisture together with their relative respirational rates.

A number of errors may creep in to alter the directness of comparison

TABLE 4. Relative respirational rates

I. Boulder series	
a. Xeric	
Gyrophora Dillenii	52.31
Dicranum fulvum	93.75
Hedwigia albicans	94.89
b. Intermediate	
Dicranum scoparium	100.00
c. Mesic	
Thuidium delicatulum	149.30
Hylocomium brevirostre	94.32
Hypnum crista-castrensis	103.45
Bazzania trilobata	68.90
II. Corticolous series	
a. Intermediate	
Porella platyphylloidea	84.94
Leucodon brachypus	54.52
Leptodon trichomitrion	76.60
b. Mesic	
Anomodon attenuatus	51.91
III. Soil mesic	
Mnium hornum	78.09
IV. Hydric	
Fontinalis dalecarlica	63.12

of the several respirational rates. Impure samples with adhering organisms, dead bryophytic tissue and adhering inorganic debris would render the respirational rates correspondingly inaccurate. It is felt that with the care taken in selecting and washing the collected materials, these are negligible factors. A second source of error involves various structural variations, as density of the samples, presence or absence of non-living parts as tomentum, variation in amount of non-respiring cell inclusions, variation in the proportion of leaves to stems and variations in cell size and thickness of the cell walls.

Differences in respiration due to variations in the density of the bryophyte samples are probably negligible while the density of the thallus of *Gyrophora* probably lowers its potential rate more strikingly by retarding the diffusion of gases. This probably accounts in part for its low comparative figure. Non-living material as tomentum is present in the two species of *Dicranum*. This would tend to lower the calculated respirational rate to a small, but unknown extent. The only form with a conspicuous amount of non-respiring cell inclusions is *Bazzania*. This would tend to lower its calculated rate to probably a small but unknown degree.

The variability of the proportion of leaf surface to stem would apparently tend to give higher respirational rates to forms exposing the larger proportion of their tissues as a single cell layer. That this is not a factor of primary importance is indicated by the fact that bryophytes similar by observation in this regard as *Thuidium* and *Hypnum* in one instance, and *Leucodon, Leptodon* and *Hedwigia* in another, have diverse relative respirational rates.

Variations in cell size, assuming densities and thicknesses of cell walls to be similar, would, it seems, have little effect on respirational rates: the increase in amount of cell wall material with more numerous cells per given area would tend to be offset by the increase of respiring cytoplasm. If the respiration rates of the different species were the same, in regard to equal amounts of protoplasm, differences in observed respiration rates might be considered to be correlated with differences in thicknesses of the cell walls. Comparison of eight of the bryophytes for relative thickness of the cell walls of leaves shows no clear correlation. Differences noted in respiration are not due primarily to this factor, though undoubtedly affected by it. Stålfelt (1937, figures 2–5), indicate that the respiration of different mosses does not increase in exact mutual proportion with increasing tempera-

ture. Such differences in this experiment over a narrow temperature range of approximately 20–25° C. are probably small, the exact discrepancies caused by this possible factor are not analyzed.

Comparison of respirational rates of different species thus presents considerable difficulties and uncertainties. That different relative respirational rates actually exist, is probably true. The actual figures are the results in part of calculations involving somewhat diverse structural organization in different species and genera (dry weights), but the major part of the differences noted is probably inherent in the several types of protoplasm.

With exceptions (for *Anòmodon* see part IV), there seems to be some indication that the bryophytes of the ecological extremes have a slower respirational rate than the more mesic species. Differences as thus analyzed do not show a linear correlation of respirational rates for bryophytes in a xeric-mesic series.

IV. VITALITY OF CERTAIN BRYOPHYTES AFTER TWELVE MONTH'S EXPERIMENTAL DROUGHT

By the regeneration method, Irmscher (1912) and Malta (1921) have shown that certain bryophytes are able to survive experimental drought for years. Plantefol (1927) showed a consistently lowered respirational rate in *Hypnum triquetrum* that had been kept in a desiccator for 1–6 months when resoaked, measured and compared with the initial rate (pp. 210–213).

From the several experiments described in part I, excess cleaned, laboratory dried moss was placed in envelopes, labelled and stored in a steam-heated laboratory during the winter. The following summer, when the experiments described in part III were performed, this stored material, just a year old, was placed in the respirators used in part III, and run with fresh *Dicranum scoparium* as control. Their respirational rates were mutually compared as indicated in the last section, and the results are given in table 5.

In the year's time, *D. scoparium* and *F. dalecarlica* failed to show respirational activity above the small experimental error in the first 24 hours when remoistened. The amount of experimental error had been ascertained in preliminary experiments. *T. delicatulum* and *H. brevirostre* showed marked reduction in vitality. It was not ascertained whether this reduction was generalized for all of the tissues or whether a portion of the cells remained fully active while the rest had died. *L. brachypus* and *G. Dillenii* gave comparable results with the

TABLE 5. Relative respirational rates of mosses, dry for a year

I. Control	
Dicranum scoparium	100.00
II. Boulder series	
a. Xeric	
Gyrophora Dillenii	66.05
b. Intermediate	
Dicranum scoparium	00.00
c. Mesic	
Thuidium delicatulum	44.17
Hylocomium brevirostre	9.89
III. Corticolous series	
a. Xeric	
Ulota crispa	25.63
b. Intermediate	
Leucodon brachypus	67.93
c. Mesic	
Anomodon attenuatus	116.77
IV. Hydric	
Fontinalis dalecarlica	00.00

fresh samples of the previous experiment, but the respiration here was somewhat higher. The remarkable increase of the year-old dry *A. attenuatus* over its fresh counterpart of the last experiment remains unexplained. If this latter figure represents the more normal comparative respirational rate, the conclusion of part III, that the mesic bryophytes show a higher respirational rate, receives additional evidence. The low figure for *U. crispa* is not easily interpreted without knowing the activity of its fresh counterpart. In general, this experiment indicates a greater degree of mortality of the mesic-hydric forms after a year of continuous air-dry storage in the laboratory.

SUMMARY

1. The pectin content of a xeric-mesic series of bryophytes was determined. Pectin is present in minute quantities. Such variations as exist in amount are apparently not correlated with habitat.

2. Absorption of moisture from the atmosphere at four different humidity levels by: (a) bryophytes with alcohol and water soluble fractions and pectins removed, and (b) by fresh bryophytes, was determined. Only minor differences were obtained with a xeric-mesic series of bryophytes. Thus, there appears to be little or no correlation between the degree of xerophytism of the bryophytes and their absorption of atmospheric moisture.

3. The respiration of a xeric-mesic series of bryophytes was determined as a possible clue to metabolic differences between ecologically diverse types. Although the comparison of different species presents a number of uncertainties, differences between bryophytes obtained are thought to represent, in part, real differences. The evidence seems to indicate that the mesic species have a greater respirational rate than either of the ecological extremes.

4. By respirational tests, the vitality of a group of ecologically diverse bryophytes after one year of experimental drought was determined. In general, the experiment indicates a greater degree of mortality for the mesic-hydric forms.

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WAR ZONE MOSSES

H. N. DIXON

From time to time I have received small collections of mosses from various islands in the western Pacific and the Malay Archipelago, scarcely sufficient in themselves, perhaps, to justify publication. Under present conditions, however, special interest has been aroused in these groups of islands, and as there are a few new species included, as well as extensions to the known distribution of several others, it seems a suitable opportunity to publish them.

Guam, the Caroline Islands, Amboina, Celebes, Borneo, Timor, and others in the following list are names which at once kindle our interest under present circumstances. I have arranged them in a series passing roughly from N. E. to S. W.

The types of the new species are in my herbarium.

MARIANNE ISLES

A small collection of mosses made in 1918 by Peter Nelson in these islands was sent me by the Bureau of Science, Manila; and one or two also were sent from the U. S. National Museum.

LEUCOPHANES SUBGLAUCESCENS C. M.—Guam, 1918, coll. Peter Nelson *446*.

BARBULA INDICA (Schwaegr.) Brid.—Guam, 1918; coll. Peter Nelson *445*.

RHACOPILUM PACIFICUM Besch.—Guam, Oct. 1911; coll. R. C. McGregor *628*, Herb. U. S. Nat. Mus.

ECTROPOTHECIUM DEALBATUM (Hornsch. & Reinw.) Jaeg.—Guam. With the last.

VESICULARIA **perangusta** Dix. sp. nov. Robusta, aurantiaca, rigida; caules elongati, dense ramosi; folia confertiuscula, *patentia*, strictiuscula, leniter falcatula, *haud complanata*, circa 1.5 mm. longa, vix .5 mm. lata, *late lanceolata, sensim longe, anguste acuminata*, integra, ecostata. Cellulae *perangustae*, longe lineari-rhomboideae, circa 130 μ longae, 16 μ latae, infra sensim laxiores, paucae basilares et alares late rectangulares. Fructus ignotus.

Hab. Guam, Marianne Is., 1918; coll. Peter Nelson (*445b*), comm. Herb. Bur. of Sci., Manila.

Of the group to which *V. Miquelii, V. Kurzii*, etc., belong, but with narrower, much more longly and finely acuminate leaves. *V. subscaturiginosa* Fleisch. has somewhat similar leaves, but the plant has a very different texture and branching, and laxer areolation.

CAROLINE ISLANDS

A few mosses from these islands were included in some insular mosses sent me for determination from the U. S. Nat. Museum, in Mar. 1932. I also received a small collection made there by S. Ogura, from my Japanese correspondent, H. Sasaoka.

LEUCOPHANES GLAUCUM (Schwaegr.) Mitt.—On rock, Pelew Is., Caroline Group, Dec. 1933; coll. S. Ogura (*10057*, *10059*), comm. H. Sasaoka. I think there is no doubt that this is this species; *L. Tetensii* C. M. from the same Group is quite different.

SYRRHOPODON BORNEËNSIS (Hampe) Jaeg.—On dead tree, Pelew Is., Carolines, Dec. 1933; coll. S. Ogura (*10055*), comm. H. Sasaoka.

CALYMPERES VOLKENSII Broth.—On dead tree, Pelew Is., Dec. 1933; coll. S. Ogura (*10053*), comm. H. Sasaoka. Endemic.

GAROVAGLIA **carolinensis** Dix. sp. nov. Pallide viridis, haud nitens. Caules usque ad 10 cm. alti, leniter curvati, *valde complanati*, 4–5 mm. lati, obtusi. Folia laxiuscula, dorsalia et ventralia erecta, appressa, lateralia *patentia* (fere horizontaliter), late *cordato-ovata*, *brevissime acute cuspidata*, profunde pluriplicata, marginibus *integris* vel ad summum apicem indistincte denticulatis, ubique planis. Costae nullae. Cellulae breviter rhomboideo-lineares, latiusculae, parietibus, praecipue ad cujusquae apicem *collenchymaticis*, 80–100 μ longae, circa 10 μ latae; basilares elongatae, parietibus incrassatis, *porosis*, infimae laxiores, ad insertionem aurantiacae, alares vix notatae. Fila articulata pellucida in axillis foliorum numerosa. Fructus ignotus.

Hab. Ponapi I., Carolines, coll. Dr. H. F. Moore (U. S. Commission of Fish & Fisheries, Str. Albatross, 1899–1900), 12 Feb. 1900 (*157*), comm. U. S. Nat. Mus.

Very distinct from most species in the very shortly pointed, almost entire leaves. These are very similar in form to those of *G. densifolia* Mitt., but the stems are not turgid as there, but very complanate, and the areolation very different.

In spite of the absence of fruit it is almost certainly a *Garovaglia*, not an *Endotrichella*.

FLORIBUNDARIA FLORIBUNDA (Doz. & Molk.) Fleisch.—Carolines, as above, coll. Dr. H. F. Moore (*158*), comm. U. S. Nat. Mus.

THUIDIUM MEYENIANUM (Hampe) Bry. jav.—On dead tree, Pelew Is., Carolines, Dec. 1933; coll. S. Ogura (*10056*).

TRICHOSTELEUM **carolinarum** Dix. sp. nov. § Thelidium. A *T. hamato* differt planta nitidiuscula, foliis paullo laxioribus, multo *brevius*, *minus tenuiter* acuminatis, *integris*, papillis grossioribus, latioribus. Fructus ignotus.

Hab. On dead tree, Pelew Is., Carolines, Dec. 1933; coll. S. Ogura (*10062*), comm. H. Sasaoka.

A distinct species, as *Thelidium* goes, in the comparatively broadly and shortly subulate, quite entire leaves.

BORNEO

ACTINODONTIUM RHAPHIDOSTEGUM (C. M.) Bry. jav.—On rock near jungle, 1060 m., Dehobang R., Kinabalu, Brit. N. Borneo, Sept. 27, 1933; coll. J. & M. S. Clemens (*40490b*), comm. E. B. Bartram.

DISTR. Java: Celebes: N. Kanara, South India. One locality in each!

ECTROPOTHECIUM STRIATULUM Bartr. & Dix.—Songkong Gebirge, bei Sambas, West Borneo, 700–1000 m., 1926; coll. Dr. K. Schaefer, comm. Th. Herzog.

AMBOINA

LEUCOPHANES OCTOBLEPHAROIDES Brid.—Sea strand, Waai, Amboina, 31 Oct., 1931; coll. A. Rant (*613*), Herb. Hort. Bot. Bog. (*2839*).

SYRRHOPODON BORNEËNSIS (Hampe) Jaeg.—Strand, Waai, Amboina, Nov., 1931; coll. A. Rant, Herb. Hort. Bot. Bog. (*2837*).

ECTROPOTHECIUM **sublaxirete** Dix. sp. nov. *E. laxireti* Dix. novae-guineensi peraffine. Differt ramis longioribus, gracillimis, dense pinnatis, foliis *integris* (raro rameis minute, indistincte denticulatis), ad basin paullo angustioribus, cellularum parietibus paullo firmioribus, et cellulis basilaribus *angustioribus, parietibus subincrassatis*. Dioicum videtur. Fructus ignotus.

Hab. Amboina, July–Nov., 1913; coll. C. B. Robinson (*2325*), comm. U. S. Nat. Mus.

Very near indeed to my *E. laxirete* (Journ. Linn. Soc. Bot., **45**: 492), which differs only in the leaves quite distinctly denticulate, while here they are practically entire, and in the basal areolation, which there is decidedly lax and hyaline, with very thin walls.

The wide upper areolation of the leaves is the special characteristic of these two species.

CELEBES

ACROPORIUM TURGIDUM (Doz. & Molk.) Fleisch.—Bonthain Peak, 189–; coll. A. H. Everett (*656*), Herb. Bot. Gard., Singapore.

Rather doubtful; the leaves agree in form, but the plant is very slender for this species; there is no fruit.

MOLUCCAS

MNIODENDRON HUMILE Lindb.—Zwischen Woloe en Manoesela, Moluccen, Dec. 1917; coll. Kornassi (*710*), Herb. Hort. Bot. Bog. (*1148*).

POGONATUM SUBMACROPHYLLUM Herz. (nec Broth.)—Woloe en Manoesela, Molukken, Dec. 1917; coll. Kornassi (*718*), Herb. Hort. Bot. Bog. (*1409*).

TERNATE

MACROMITRIUM MICROPOMA Fleisch.—Toramadiahi, Ternate, Moluccas, Jan. 1921; coll. Beguin (*1313*), Herb. Hort. Bot. Bog. (*2125*).

This agrees well with *M. micropoma* Fleisch., which Fleischer published as a subspecies of *M. orthostichum* Nees. DISTR. Java.

EIL SIANKAN (West of Gt. Natunas)

VESICULARIA KURZII (Lac.) Broth.—N. W. of Terempo, Eil Siantan, Apr. 1928, coll. Van Steenis (*886*), Herb. Hort. Bot. Bog. (*2243*).

TALAUD I. (?Talaur recte)

LEUCOPHANES CANDIDUM (Hornsch.) Lindb.—G. Piapi, Karakelang, May 1926; coll. H. J. Lam (*3282*), Herb. Hort. Bot. Bog. (*2528*). A rather remarkable form, fuscescent, with the leaves suberect.

SYRRHOPODON (Thyridium) FASCICULATUS Hook. & Grev.—Karakelang, May, 1926; coll. H. J. Lam (*2953*), Herb. Hort. Bot. Bog. (*2513*).

PELEKIUM VELATUM Mitt.—Karakelang, May, 1926; coll. H. J. Lam, Herb. Hort. Bot. Bog. (*2576*).

THUIDIUM PLUMULOSUM (Doz. & Molk.) Bry. jav.—Karakelang, May, 1926; coll. H. J. Lam (*3212*), Herb. Hort. Bot. Bog. (*2579*).

CLASTOBRYUM INDICUM Doz. & Molk.—Karakelang, May, 1926; coll. H. J. Lam (*3281*), Herb. Hort. Bot. Bog. (*2568*).

BURU

LEUCOBRYUM SANCTUM (Brid.) Hampe—Takal, Aug. 1921; coll. Toxopens, Herb. Hort. Bot. Bog. (*2116*).

RHACOPILUM SPECTABILE Hornsch. & Reinw.—Ibidem (*2118*).

SPIRIDENS REINWARDTII Nees—Ibidem (*2111*).

HYPOPTERYGIUM CEYLANICUM Mitt.—Buru, 1921; coll. Saprin, Herb. Hort. Bot. Bog. (*2112*).

DAWSONIA ALTISSIMA Geh.—Nal Besi, Buru, Apr. 1921; coll.

Saprin (*201*), Herb. Hort. Bot. Bog. (*2113*). A form with seta very short. There is no other character that I can find to separate it from this species. The Celebes plant has the same feature.

DISTR. Borneo: Celebes.

WARBURGIELLA LEPTOCARPA Fleisch. (*Hypnum leptocarpon* Schwaegr.) (non *H. leptocarpon* Bry. jav.). West Elen, circa 1600 m., Mittel Buru; coll. K. Deninger, 1911 (*39*), comm. Th. Herzog.

VESICULARIA **buruensis** Dix. sp. nov. Gracilis, *terrestris*, vix nitida; rami perbreves, subcomplanati, folia conferta, parva, eis *V. perangustae* supra descriptae subsimilia sed minora, infra paullo latiora, magis raptim, brevius acuminata, *falcata*. Cellulae breviores, latiores, 15–19 μ latae, parietibus *pertenuibus*. Bracteae perichaetii perfalcatae, filiformi-subulatae, integrae. Seta 1 cm. Theca sat alte mammosa.

Hab. Takal, Buru, Aug. 1921; coll. Toxopens (*439*), Herb. Hort. Bot. Bog. (*2115*).

Like a small and delicate form of *V. Kurzii*, but with much finer points to the leaves, and with a different habitat. *V. filicuspes* Broth. has *inter alia* a longer seta. The cell walls here are remarkably thin, and the tissue very delicate, but this is sometimes masked by the cell contents, especially when the cells refuse to moisten out, as often happens in this genus.

CERAM

MNIODENDRON KORTHALSII Bry. jav.—Mittel Ceram, 1911; coll. E. Stresemann (*2*).

CAMPYLOPUS CAUDATUS (C. M.) Mont.—Hoale, 1911; coll. E. Stresemann (*36*).

MNIODENDRON MITTENII Salm.—Passhöhe Manoela—Wolu, circa 1750 m. 1911; coll. E. Stresemann (*37*), comm. Th. Herzog.

PSEUDOHYPNELLA VERRUCOSA (Doz. & Molk.) Fleisch.—Hoale, 1911; coll. E. Stresemann (*35 p. p.*), comm. Th. Herzog.

KAI

THUIDIUM PLUMULOSUM (Doz. & Molk.) Bry. jav.—(Coll. ?) Herb. Hort. Bot. Bog. (*2119*).

TIMOR

MYURIUM RUFESCENS (Hornsch. & Reinw.) Fleisch. var. PROLONGATUM (Broth.) Fleisch.—Timor, coll. Forbes (*2550*), Herb. Hort. Bot. Bog. (*2109*).

BALI

LEUCOBRYUM JAVENSE (Brid.) Mitt.—G. Pali, Sept. 1918, coll. Maier-Sarip, Herb. Hort. Bot. Bog. (*2106*).

BRYUM NITENS Hook.—Bali, 1911; coll. E. Stresemann (*30*), comm. Th. Herzog.

BRYUM AMBIGUUM Duby—Ibidem (*29*). c. fr.

HYPNODENDRON JUNGHUHNII (C. M.) Lindb.—G. Pala, Sept. 1918, coll. Maier-Sarip (*328*), Herb. Hort. Bot. Bog. (*2107*).

ENDOTRICHELLA ALARIS Broth.—Auf Kaffeebäumen, beim Bratansee, Ins. Bali, 1930–31; coll. O. Renner (*227*), comm. Th. Herzog.

HOMALIODENDRON SCALPELLIFOLIUM (Mitt.) Fleisch.—G. Pali, Sept. 1918; coll. Maier-Sarip, Herb. Hort. Bot. Bog. (*2108*).

ISOPTERYGIUM ALBESCENS (Schwaegr.) Jaeg.—Bali, 1911; coll. E. Stresemann (*32*), comm. Th. Herzog.

ECTROPOTHECIUM BUITENZORGII (Bél.) Jaeg.—Bali, 1911; coll. E. Stresemann (*31*), comm. Th. Herzog.

ECTROPOTHECIUM DEALBATUM (Hornsch. & Reinw.) Jaeg.—Bali, 1911; coll. Dr. O. Tauern & E. Stresemann (*28*), comm. Th. Herzog. c. fr.

JAVA

DICRANELLA **sclerophylla** Dix. sp. nov. Dense late caespitosum; pulchre fusco-rufescens; caules circa 1 cm. alti, flexuosi, gracillimi. Folia inferiora laxiuscula, patentia, superiora conferta, erecta, subcomosa, subfragilia, *parva*, 1 mm. longa, *perstricta*, e basi lanceolata sensim *breviuscule*, *latiuscule* acuminata, *subobtusa*, *integerrima*, concava. Costa valida, circa ¼ latitudinem folii basis aequans, circa 60 μ lata, cum acumine soluta vel breviter excurrens. Cellulae superiores breviter anguste rectangulares, basilares laxiores, parietibus firmis, omnes *pellucidae*, *flavae*. Fructus ignotus.

Hab. G. Papandajan, Res. Priangan, Jav. Occ., 2300–2500 m., in valle torrentis Tiji Paroegpoeg, July 1930; coll. Fr. Verdoorn (*3423*).

Distinguished from the allied species by the strict, firm leaves, with short, scarcely acute acumen. Nearest to *D. Wichurae* Fleisch., but without the lax basal and alar cells of that species.

Dr. Reimers has kindly compared it with this and other Malayan species and agrees with me that it is undescribed.

It is not impossible that it may be a *Ditrichum*, but it does not agree with any known species, and its close resemblance to *D. Wichurae* indicates a co-generic position.

HYPNODENDRON COPELANDII Broth.—Nirmala, Java, Dec. 1913; coll. C. A. Backer, comm. Herb. Hort. Bot. Bog. (*2080*). In fruit.

TRACHYPUS BICOLOR Hornsch. & Reinw., var. nov. **simplicicaulis** Dix.—Stems robust, simple or very slightly branched. G. Patoeha, circa 2,000 m., Java Occ., 1929; coll. Veldhuis (267), comm. Fr. Verdoorn.

A very marked variety, in the very robust, simple or almost simple stems, or secondary branches, 8 cm. long or more. A gathering of the species from the same locality, however, showed stems with the same robust habit, but fairly densely branched, so that the variety is evidently not a very stable one. It is however, such a marked form that it seems well to describe it as a var. It is of a dark brown colour, with yellowish tips to the branches, with the leaf direction of *T. cuspidatus*, but the colouring of *T. bicolor*.

CLASTOBRYUM SERRATUM Dix.—Kandang Badak, auf Bäumen bei d. Hütte, 1931; coll. O. Renner (*167*). Endemic. Sent by Th. Herzog, as ? *Acroporium*. It has not, I believe, been found except in the original locality, which is unspecified, by Motley.

ACROPORIUM WARBURGII (Broth.) Fleisch. (*A. pinnatum* Fleisch.)—G. Gede, Res. Priangan, Java Occ., in decl. G. Pangerango, 2700–3060 m., Aug. 1930; coll. Fr. Verdoorn (*2118*).

BANCA AND EIL LEPAR

LEUCOPHANES CANDIDUM (Hornsch.) var. DENSIFOLIUM (Mitt.) Dix.—Pulu Lepar, S. Koedjik, Dec. 1917; coll. Bünnemeijer (*2447*), comm. Herb. Hort. Bot. Bog. (*2236*).

LEUCOBRYUM SANCTUM (Brid.) Hampe—Banca, coll. H. de Leeuw, Herb. Hort. Bot. Bog. (*2232, 2234*).

LEUCOBRYUM ADUNCUM Doz. & Molk.—Banca, Herb. Hort. Bot. Bog. (*2241*).

SYRRHOPODON UNDULATUS (Doz. & Molk.) Lindb.—Eil Lepar, Banka; coll. Teysmann (*91*), comm. Herb. Hort. Bot. Bog. (*1764*).

This combines the characters of *S. undulatus* and *S. fasciculatus*, as given by Fleischer, and serves to confirm the identity of the two.

RHIZOGONIUM LATIFOLIUM Bry. jav.—Bentja, Banca, Dec. 1917; coll. Bünnemeijer (*2301*), Herb. Hort. Bot. Bog. (*2233*). In good fruit.

RHIZOGONIUM SPINIFORME (Hedw.) Bruch—Ibidem (*2235*).

SUMATRA

FISSIDENS ANOMALUS Mont.—G. Singalang, 1894; coll. V. Schiffner, comm. J. Baumgartner. New to Sumatra. It is a form with the leaves narrower than usual, and more narrowly acuminate.

SYRRHOPODON ACUTISSIMUS Dix.—Bantjah dalam, 1200–1300 m., west coast of Sumatra, coll. Goebel, comm. Th. Herzog (*25*). Only known from the original locality.

HYMENOSTYLIUM RECURVIROSTRUM (Hedw.) Dix. var. LUZONENSE (Broth.) Bartr.—Sumatra media; fontes calc. ad lacum Singkarak pr. Padang, circa 400 m., 6 Mar. 1929; coll. F. Ruttner, comm. J. Baumgartner (*5*). Very near indeed to the Philippines plant, if not actually quite identical.

HYOPHILA **angustiuscula** Baumg. & Dix. sp. nov. Sat robusta, atro-viridis. *H. involutae, H. Micholtzii,* &c., affinis; differt foliis basi *latiore,* expansa, late *acutata,* saepius acuta, versus apicem sat regulariter, *argute, fortiter* denticulata; costa *pervalida,* ad basin circa 120 μ lata; cellulis *multo majoribus,* 11–14 μ latis, laevissimis. Fructus ignotus.

Hab. Danau di Atar (lacus) pr. Padang, submersa in aqua fluente, Sumatra media, circa 1530 m., 16 Mar. 1939; coll. Feuerborn (*16*), comm. J. Baumgartner.

Like other plants of the genus a not very striking species, the leaves varying considerably. The broad base, rather acute acumen, sharp and rather regular toothing, strong nerve, and especially the large cells, distinguish it fairly clearly.

H. grandiretis Dix. & Varde from S. India has leaves from a very narrow base, weaker nerve, and only faintly toothed margin.

BARBULA **sumatrana** Baumg. & Dix. sp. nov. § Hydrogonium. Caulis 4–5 cm. altus, supra divisus, *densifolius;* folia patula, sicca fortiter flexuoso-incurva, 3 mm. longa, *fragilia,* stricta, e basi longe oblongo-lanceolata, .5 mm. vel paullo ultra lata, sensim *breviter late* acuminata, apice *late acuto,* parum incurvo; margines ubique fere *fortiter anguste* recurvi, *fortiter mammoso-crenulati.* Costa valida, ad apicem percurrens vel breviter late excurrens. Cellulae subellipticae, parietibus angustis, circa 8–10 μ latae, *grosse sed humiliter papillosae,* basilares laxiores, pellucidae, *parvae,* breviter rectangulares, parietibus firmis. Fructus haud visus.

Hab. Fontes calcarei ad lacum Singkarak, prope Padang, Sumatra media, circa 400 m., 6 Mar. 1929; coll. C. F. Ruttner (*4a*), comm. J. Baumgartner.

A much larger plant than *B. javanica* Doz. & Molk., with much narrower leaf points, the apex almost occupied by the stout, subper-

current nerve. Distinct also in the very closely but narrowly recurved margin, and the coarsely though lowly tuberculate cells.

WEBERA LEPTOCARPA Bry. jav.—Fort de Koek, Sumatra, Jan. 1925; coll. Goebel, comm. Th. Herzog (*s. n.*).

New to Sumatra. DISTR. Java: Borneo.

ENDOTRICHELLA FORMOSA Dix. ined.—Brastagi, Sumatra, 1925; coll. Goebel, comm. Th. Herzog, as ? *Garovaglia.*

I have it also from Pahang, Malaya, and at the time of writing the description is in the printer's hands.

BARBELLA ENERVIS (Thw. & Mitt.) Fleisch.—Umgebung des Tobasees, Sumatra, 1926; coll. Missionar Maibach, comm. Th. Herzog (*306*).

New to Sumatra.

CLASTOBRYELLA CUCULLIGERA (Bry. jav.) Fleisch.—Sumatra, 1880–1882; coll. H. O. Forbes; Herb. Mus. Brit. (1973). Only recorded from Ceylon and Java, but I have another Sumatran specimen, from branch of tree, Brastagi, Feb. 1921, coll. H. N. Ridley, Herb. Kew., and it is also found in the Philippines, Siam, and the Malay Peninsula.

TAXITHELIUM ISOCLADIOIDES Dix.—Brastagi, 1925; coll. Goebel, comm. Th. Herzog, unnamed. It differs slightly from the original plant in having the leaves almost entire. DISTR. Malay penins.; Borneo.

BURMA

POGONATUM FASTIGIATUM Mitt.—Clay banks in forest, west side of the Chim-li (? Chim-la), 3400 m., N. E. Upper Burma, 1924–25; coll. G. Forrest (*2505–3*), Herb. Kew (*95*).

New to Burma. DISTR. Sikkim: Assam.

A MOSS NEW TO FLORIDA

MARY W. DIDDELL AND EDWARD M. SHIELDS

Much of our spare time during the past fall has been spent in studying the Pteridophyta to be found in the limesinks in the portion of the Florida Oligocene Island region, easily accessible to Jacksonville.

Our method of locating the sinks is to turn off the highway onto a dirt road, drive slowly, watching for small clumps of hardwood trees, which, especially if isolated in otherwise open fields, will frequently be found to enclose sinks.

On the morning of November 15th, we drove to Newberry, which is a small town a few miles west of Gainesville. A little south of Newberry we turned off on a side road and soon reached a good prospect, two clumps of trees in a large field. The first near the fence proved barren, but the other group, farther back, surrounded a small sink with perpendicular sides. However, with the aid of a few toe-holds and a knotted rope tied to a tree at the top, we reached the bottom without difficulty. The sink floor sloped sharply down to a narrow, cave-like opening and here the walls narrowed together, one face bulging outward toward the other wall, forming a corner which one had to turn to reach the bottom. On the lowest part of this corner face, we noticed some tiny plants with somewhat the habit of *Trichomanes,* but on examination the leaves appeared to resemble those of *Mnium* and the discovery of a fruiting specimen proved them to be mosses. Only a few were in fruit though a few good specimens were secured and later, not being able to find it in "Mosses with a Hand-Lens," some were sent to Dr. Grout, who identified them as *Hypopterygium tamarisci* (Sw.) Brid., a species found in the West Indies, beautiful Costa Rica and South America, but never before in the United States.

On November 29th, being again in the neighborhood, we went back and found hundreds of new plants appearing on all the lower walls of the sink and many of the older plants beginning to fruit. Many of the rock Aspleniums found in these sinks tend to partial or complete summer dormancy and it is probable that this moss has the same habit. Growing with it in the sink are unusually fine specimens of the ferns: *Asplenium abscissum* and *Goniopteris reptans.* Growing in close colonies and scattered about over the walls is the ever-present *Asplenium heterochroum.*

Hypopterygium tamarisci is a beautiful plant, medium to dark olive green, miniaturely arborescent, flabellate to irregular in outline, up to 3 cm. high, 2–2.05 cm. wide, in mature specimens the lower branches again pinnate, leaves distichous, complanate, the long-stalked sporocarps completely overtopping the plants. Two or more plants may be widely spaced on connecting prostrate rhizome-like stems.

We have explored a great many sinks over a considerable area, but have never found this moss in any of the others.

NOTE ON HYPOPTERYGIUM

A. J. GROUT

We have one other species of *Hypopterygium*, *H. japonicum* Mitt., from the west coast of British Columbia. The genus has many species in tropical and subtropical regions.

H. tamarisci in general habit is strongly dendroid in habit from prostrate stolons, somewhat resembling *Porotrichum*. It is distinguished by being distichous and having a third row of smaller leaves much as in many species of Hepatics, these are often called amphigastria. The distichous leaves have the costa extending to the leaf middle or beyond and are bordered and toothed much as in *Mnium*, with very similar oblong-hexagonal cells and a similar sporophyte.

Rhacopilum tomentosum from Florida and Louisiana has similar leaves and amphigastria, but is not dendroid and the leaves are not bordered.

MANATEE, FLORIDA

NEWS OF THE SOCIETY

HENRY S. CONARD, PRESIDENT

Of the ballots sent out in October, 80 were returned. The vote shows 72 in favor of dues of $2.50 for all members and subscribers. In favor of publishing THE BRYOLOGIST quarterly, at least for the duration, were 72 votes. In favor of retaining Dr. Steere as Editor *in absentia* were 71 votes. In order to care for the publication without loss of time, the officers have appointed Dr. A. J. Sharp, University of Tennessee, Knoxville, Tenn., Acting Editor while the Editor is away. Dr. Sharp has accepted the appointment on that basis.

Your officers decided in November to cancel the Annual Meeting which was to have been held in New York, in accord with government advices urging cancellation. Later the whole A. A. A. S. program was called off.

The work of the Society should go on unabated; we hope to publish more pages of text than before. Collect, write letters to members, prepare papers for publication. With less transportation we can work more intensively the local scene. Very few localities have been entirely exhausted.

Jan. 1, 1943.

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THE SYSTEMATIC POSITION OF THE GENERA WARDIA, HYDROPOGON, AND HYDROPOGONELLA*

WINONA H. WELCH

INTRODUCTION

For a number of years the writer has been actively engaged in a study of species of mosses commonly included in the family Fontinalaceae, and in 1934 published a monographic treatment of those species occurring in North America north of Mexico.[1]

Following Cardot's Monographie des Fontinalacées of 1892 the family has been treated by most authors as consisting of the six genera, *Fontinalis, Dichelyma, Brachelyma, Wardia, Hydropogon,* and *Hydropogonella.* After having carefully examined a large number of specimens represented in European and American herbaria, including the types of nearly all of the known species, the writer has concluded that the genera *Wardia, Hydropogon,* and *Hydropogonella* do not form a natural alliance with the other three. An impressive and, it is believed, significant difference appears in the character of the peristome. The trellis-like inner portion of the peristome is conspicuous and well developed in the first three genera but totally lacking in the last three. In addition to the marked contrasts in the peristome characters there are many other significant differences which are discussed more fully under the respective genera.

Because of the very noticeable divergence of characteristics shown by (1) *Wardia,* (2) *Hydropogon,* and *Hydropogonella,* and (3) *Fontinalis, Dichelyma,* and *Brachelyma,* it has been difficult to accept the

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[1] A. J. Grout, Moss Flora of North America north of Mexico 3: 233–262, *pls. 73–79.* 1934.

idea that these genera constitute a natural and homogeneous unit. If these genera (1, 2) are to be excluded, and if there is no other family of mosses to which they are any more closely related than to the Fontinalaceae, it becomes necessary to establish new families to include the three genera thus segregated. The characteristics of *Wardia* are sufficiently different from those of *Hydropogon* and *Hydropogonella* to constitute a family to itself which is herein described as the new family Wardiaceae. The genera *Hydropogon* and *Hydropogonella*, however, are obviously members of the same category and are included under the family Hydropogonaceae also described as new.

Wardiaceae fam. nov.

Plantae submersae; caulibus rigidis, inferne indivisis, superne in ramos fasciculatos breves teretes rigidos divisis; foliis quinquefariis amplexicaulis enervis, cellulis alaribus dilatatis, valde conspicuis; dioicae; fructu acrocarpio, saepe cum innovatione sub perichaetio; foliis perichaetialibus squarrosis; seta brevi erecta; calyptra dimidiata; urna sine annulo; operculo ad columellam persistente adnato; peristomio simplici brevi prope obsoleto.

Plants submerged; stems rigid, at base simple, above divided into short, rigid, terete, fasciculate branches; leaves pentastichous, amplexicaul, ecostate, alar cells enlarged, very conspicuous. Dioecious; sporophyte acrocarpous frequently with innovation from just below the perichaetium; perichaetial leaves squarrose; seta short, erect; calyptra dimidiate; urn without annulus; operculum persistently attached to columella; peristome simple, short, rudimentary.

Wardia Harvey and Hooker

Wardia Harvey and Hooker, in W. J. Hooker, Companion to the Botanical Magazine **2**: 183. 1837.[2]

Neckera. Section 5 Leucodon, subsection 2 Harrisonia, according to C. Müller, Synopsis Muscorum Frondosorum **2**: 667. 1851.

Plants aquatic, somewhat robust, usually fasciculate in habit, stem denuded below the branches or nearly so; branches rigid, terete; leaves pentastichous, firm, amplexicaul, closely imbricate, squarrose, erect-spreading, or erect-imbricate, ecostate, concave, usually ovate, entire, apices acute or acuminate, median leaf cells linear-attenuate, or linear-rhomboidal, alar cells enlarged, quadrate, rectangular, or hexagonal, very conspicuous. Sporophyte acrocarpous frequently with innovation from just below the perichaetium; perichaetial leaves

[2] The publication date of the type description of *Wardia hygrometrica* Harvey and Hooker is commonly cited as 1836. According to Sprague (1933) the true publication date was Jan. 1, 1837.

squarrose, oval to orbicular, concave; seta short, erect, twisted when dry, calyptra long conical, dimidiate; urn oval, annulus none; operculum conical, obliquely rostrate, persistently attached to columella; peristome simple, short, rudimentary; spores yellowish green, smooth or very finely muricate. (Named for N. B. Ward of London, England, a physician, botanist, bryologist, and inventor of the Wardian case.)

Wardia hygrometrica Harvey and Hooker

Wardia hygrometrica Harvey and Hooker, in W. J. Hooker, Companion to the Botanical Magazine **2**: 183. 1837.

Neckera hygrometrica C. Müller, Synopsis Muscorum Frondosorum **2**: 667. 1851.

Plants submerged, rather robust in appearance, usually glossy, green, yellowish green, grayish green, or brownish green, brown to black toward basal region; stems dark brown to black, rigid, central cylinder undifferentiated, up to 9 cm. in length and 0.75 mm. in diameter, sometimes almost denuded in portions below branches and scaly with remnants of leaves, simple below, irregularly divided above into numerous, close, short, unequal branches, up to 2 cm. in length, appearing fasciculate; leaves closely imbricate, amplexicaul, up to 0.25 mm. apart, squarrose, erect-spreading, or erect-imbricate, pentastichous, firm, concave, ecostate, usually ovate or ovate-lanceolate, sometimes oval, margins frequently slightly involute on one or both sides toward apices, 1.00–2.00 mm. long, 0.50–1.00 mm. wide, 1.0–2.5 : 1, apices acute or acuminate, frequently abruptly acuminate, occasionally obtuse or subobtuse, entire, cells smooth, apical and median cells linear, attenuate, commonly flexuous, the median 5.0–8.5 μ wide, 8–20 : 1, basal cells between auricles linear, obtuse, flexuous, yellowish, alar group very conspicuous, cells enlarged, hyaline, yellowish, or yellowish brown, quadrate, rectangular, or hexagonal, occasionally forming slight auricles. Dioecious; sporophyte acrocarpous frequently with innovation from just below the perichaetium; perichaetium 1.0–3.0 mm. long, perichaetial leaves squarrose, concave, ecostate, oval to orbicular, 1.50–2.00 mm. long, 1.30–1.75 mm. wide, apices short, very slightly narrowed and obtuse, occasionally briefly mucronate; cells rhomboidal, rectangular, or linear, attenuate or obtuse, some flexuous, 6.5–10.5 μ wide, up to 15 : 1; seta erect, smooth, brown to black, twisted when dry, 4.00–9.50 mm. in length and 0.25–0.60 mm. in diameter, up to 0.80 mm. in diameter at junction with urn; calyptra long conical, symmetrical, 2.00–2.25 mm. in length, 0.75–1.00 mm. in diameter, base very slightly lacerate, eventually dimidiate; urn erect, brown to black, oval, thick-walled, somewhat angular when dry, truncate at mouth after falling of operculum, without annulus and stomata, tapering into seta, 1.25–2.00 mm. in length, 0.65–1.50 mm. in diameter; operculum conical, rostrate, beak oblique, 0.50–1.25 mm. long, 0.50–1.00 mm. in diameter, persistently

attached to columella; peristome single, seeming to develop from a narrow membrane, divisions or teeth[3] reddish brown or yellowish brown at base and yellowish to hyaline toward obtuse apices, short, unequal in length and width, up to 97.5 μ long and 25.5 μ wide, up to 142.5 μ long if measured on interior surface of urn, smooth, usually consisting of cells irregular in size and arrangement, lamellae, if distinct, 4–10; spores yellowish green, smooth to very finely muricate, 20.5–30.5 μ in diameter, mature in October.

In the type description Harvey and Hooker (1837) do not mention the male plants. Cardot (1892) and Brotherus (1905 and 1925) state that the male plants are unknown. On each of the three sheets of *H. 1590* (the selected type), in the herbarium of the Royal Gardens, Kew, the writer has found male plants. They are easily recognized because the branches of the male plants do not appear fasciculate, are much shorter than those of the female plants, and the ends of the stems and branches are obtuse or truncate instead of acute or acuminate as in the female plants. The antheridia are 75.0–112.5 μ wide and 487.5–562.5 μ long, 4.0–7.5 : 1. With one exception antheridia and archegonia were found on separate plants.

Type: not designated by Harvey and Hooker. In the absence of material so indicated the plants, in fruit, in the Herbarium of the Royal Gardens, Kew, England, marked *H. 1590*,[4] have been selected by the writer to represent the type. In the herbarium of the British Museum of Natural History in London there are also plants under the same number, but the Kew material was selected and so designated because Hooker's moss collection is in the Kew Herbarium as well as the original drawings for *plate 25* with the notation, "For Companion to the Mag. Sir W. J. Hooker."

Type collector: W. H. Harvey. Date unknown.

Type locality: on the stony bed of a small mountain rivulet, at Paradise, on the eastern side of Table Mountain, Cape of Good Hope, Africa.

Distribution: known only from Cape of Good Hope, South Africa.

Additional descriptions: Brotherus, V. F., in Engler, A. and Prantl, K., Die natürlichen Pflanzenfamilien. 223. Lieferung: 723. 1905; Brotherus, V. F., in Engler, A. and Prantl, K., Die natürlichen

[3] An attempt has been made to count the rudimentary teeth in numerous peristomes. The divisions are so indistinct and so irregular in length and width that it is impossible to state the number accurately. It seems to be between 32 and 48.

[4] It has been assumed that *H. 1590* specifies the plants which were used by Hooker for drawings with a corresponding number.

Pflanzenfamilien. **II.** Band. Musci (Laubmoose). 2. Hälfte: 55–56. 1925; Cardot, J., Monographie des Fontinalacées, p. 129. 1892; Müller, C., Synopsis Muscorum Frondosorum **2**: 667. 1851; Schwaegrichen, F., Supplementum 4: (pages not numbered). 1842.

Illustrations: Brotherus, V. F., in Engler, A. and Prantl, K., Die natürlichen Pflanzenfamilien. 223. Lieferung: *fig. 541.* 1905; Brotherus, V. F., in Engler, A. and Prantl, K., Die natürlichen Pflanzenfamilien. **II.** Band. Musci (Laubmoose). 2. Hälfte: *fig. 471.* 1925; Hooker, W. J., Companion to the Botanical Magazine **2**: *pl. 25.* 1837; Schwaegrichen, F., Supplementum 4: *pl. 314.* 1842.

Specimens examined:

Bergius, (H.); *Breutel*, Pavians Rivier, (BM., H., PC., S.); *Breutel*, Gradenthal, (B., BM., G-Bois., K., PC., S.); *Burchell 6995*, Cataracts, (K.); *Ecklon C. F. 91*, November, 1825, (S.), 11-9-1825, (BM., H., S.), *s. n. d.*, (S.); *Ecklon*, and *Zeyher*, in 1847, (G-Bois.); *Garside, S.*, South African Bryophyta *79*, on rocks near stream, First Waterfall, Jonkers Hock., April 18, 1920, (Dixon, DPU.); *Greville, Dr.*, (BM.); *Harvey, W. H.*, in 1834 (G-Bois.), Wardia Rock, Table Mountain, October, 1837, (G-Bois., K.), Drakenstein Waterfall, Table Mountain, (B., K.), Mountain Rills, (BM.), C. B. S., (FH.); *Hey 5*, Smalleblaar River, Worcester District, 10-22-1925, (DPU., FH., WELC.); *Jelinek*, Kryptogamae exsiccatae editae a Mus. Hist. Nat. Vindobon *2988*, in rivulis circa sinum "Simonsbay," (BR., G-Bois., K., US.); *MacGillivray, John*, stream at Witte Klip, Table Mountain, December, 1852, (K.); *MacOwan 72*, (BR., H., PC.), *s. n. d.*, (PC.); *Pillans, N. S. 4076*, rocks under water, Table Mountain, Cape Town, 2-11-19, (Dixon, DPU.); *Rehmann, Dr. A.*, Musci austro-africani (1875–77) *302*, in stream, Table Mountain, (B., H., K., PC., S.), in stream, Table Mountain, 1875–77, (BM., S.); *Roser, Dr.*, August, 1854, (B., BM., K.); *Sprengel*, (BM.); *Wager, H. A. 8*, on stones in dripping water, Table Mountain, Cape Town, (Dixon, DPU.), *93*, Table Mountain, (H.), *343*, Cape Town, in 1915, (Dixon, DPU.); *Ward, N. B.*, Wardia Rock, Table Mountain, November, 1838, (BM., G-Bois.); *Zeyher*, Flora Capensis, in stream, Table Mountain, 2500′–3500′, November, (PC.).

In the general characteristics accompanying the type description of *Wardia hygrometrica* Harvey and Hooker, Hooker (1837) states that this aquatic moss has the habit of the Scouleriae, differing in the seta being evident. He further comments on the duplication of habitat of *Wardia hygrometrica* on "stones washed by the running stream" on Table Mountain, Cape of Good Hope, with that of "*Scouleria aquatica* in North-West America", and adds that "the unusual character of the firm union of the operculum with the columella, after the former has separated from the capsule, exists in these two river mosses widely separated geographically".

In his Synopsis Muscorum Frondosorum, C. Müller (1851) considers *Wardia hygrometrica* as a synonym of *Neckera hygrometrica* C. Müller, which he places in the Subsection Harrisonia Spreng.

J. Cardot (1892) in his Monographie des Fontinalacées accepted the

opinion of Jaeger and Sauerbeck (1879 or 1880), who in the Adumbratio Florae Muscorum classified *Wardia* as a genus in the Fontinalaceae. In a Supplement to the Adumbratio Florae Muscorum, Jaeger and Sauerbeck (1879 or 1880) place *Wardia* in the Cryphaeaceae instead of the Fontinalaceae.

V. F. Brotherus (1905 and 1925) in Engler and Prantl, Die natürlichen Pflanzenfamilien, follows Cardot's Monographie des Fontinalacées and likewise places *Wardia* in this family.

H. N. Dixon (1931) in discussing the position of *Wardia* in the Fontinalaceae states that it is "little more than conjectural; the extremely rudimentary peristome gives no clue to its affinity."

The author does not consider *Wardia* as a genus in the Fontinalaceae because the sporophyte is acrocarpous frequently with an innovation just below the perichaetium rather than cladocarpous; the perichaetial leaves are squarrose instead of imbricate as in the other genera of that family; the columella is persistently attached to the operculum which is not true of the other genera thus far included in the Fontinalaceae; and the peristome is simple and very rudimentary in contrast with a well developed peristome encircling a trellis-like structure formed by the cilia and transverse bars as in *Fontinalis*, *Dichelyma*, and *Brachelyma*. The gametophytes vary in *Wardia* usually being much smaller and more robust in habit, in stems commonly simple below and somewhat fasciculately divided above rather than being regularly or irregularly pinnate throughout, in leaves pentastichous instead of tristichous, amplexicaul rather than somewhat decurrent, not carinate or carinate-conduplicate as in *Dichelyma*, *Brachelyma*, and several species and varieties of *Fontinalis*, and much more closely placed on the stem than is common in the Fontinalaceae.

Hooker who described *Scouleria* in 1830 and *Wardia* in 1837 suggested a relationship between these genera. *Scouleria* and *Wardia* sporophytes have in common the elongated columella persistently attached to the operculum, annulus undifferentiated, and the seta not convolutely clasped by the perichaetial leaves. But there are conspicuous differences in the habit of the plants, the form and structure of the leaves, both vegetative and perichaetial, the length of seta, the form of urn, operculum, and calyptra, and in the structure of the peristome. Because of these differences the writer does not consider *Wardia* and *Scouleria* as genera in the same family.

In discussing the position of *Sclerohypnum*, Dixon (1931) places

this genus with question in the Fontinalaceae because of a marked resemblance with *Wardia* in habit, leaf form, and structure. However, he notes no affinity with this family in peristome characters. Dixon suggests that perhaps *Wardia* and *Sclerohypnum* should be placed in a new family which would not be necessarily near Fontinalaceae. The writer acknowledges resemblances between these genera in leaf shape and arrangement, in seta length, and in capsule form, but detects striking differences in plant habit, leaf structure, perichaetial leaf form, sporophyte position, and in peristome structure. The author does not consider *Sclerohypnum* as one of the genera in the Fontinalaceae because of the absence of cilia and the characteristic trellis-like inner peristome and the presence of an endostome, and does not place this genus in the Wardiaceae because of the double, well developed, hypnoid peristome.

Hydropogonaceae fam. nov.

Plantae submersae; caulibus fluitantibus, elongatis, pinnate divisis, ramis brevibus; foliis caulinis trifariis aut quinquefariis, remotis ad laxe erecto-imbricata, oblongis, ovatis, obovatis ellipticatis, aut ovalibus, planis ad concava, enervis aut nervis brevibus et inaequaliter biramicatis, margine erecto aut reflexo, apice obtuso ad breviter acuminatum, integro aut serrulato, mediis cellulis levibus, hexagonis ad rhomboideas, alaribus inconspicuis, nullis auriculis; monoicae; fructu cladocarpio aut pseudocladocarpio; calyptra conica; urna immersa ad submersam, sessili aut subsessili, ovali ad subcylindracem, sine annulo; operculo maturo plano et rostellato; nullo peristomio aut sedecim dentibus brevibus.

Plants submerged; stems floating, elongate, pinnately divided, branches short; cauline leaves tristichous or pentastichous, distant to loosely erect-imbricate, oblong, ovate, obovate, elliptic, or oval, plane to concave, ecostate or with costa short and unequally forked, margins plane or revolute, apices obtuse to briefly acuminate, entire or serrulate; median cells smooth, hexagonal to rhomboidal, alar cells inconspicuous, not forming auricles. Monoecious; sporophyte cladocarpous or pseudocladocarpous; calyptra conical; urn immersed to slightly emergent, sessile to subsessile, oval to subcylindrical; annulus none; mature operculum plane and rostellate; peristome none or consisting of 16 short teeth.

Although there are outstanding differences between *Hydropogon* and *Hydropogonella* as shown in the following key to the genera, the writer is placing them in the same family, Hydropogonaceae, because their habits and habitats are comparable, the leaves are somewhat

similar in form and structure, the plants are monoecious, the male flowers of both genera are in proximity to the female flowers, the capsules are comparable in size and shape, sessile or nearly so, and immersed to slightly emergent, and the spores are similar in size and appearance.

KEY TO GENERA OF HYDROPOGONACEAE

Cauline leaves pentastichous, loosely erect-imbricate, concave, costate at base with an unequally forked short nerve, or ecostate, serrulate, oval, ovate, oblong, or obovate, 2.00–3.00 mm. long, 0.75–1.35 mm. wide; sporophytes pseudocladocarpous, hidden among leaves at or near ends of branches; capsule suboval, oval, or subcylindric, 0.50–0.75 mm. long, 0.25–0.60 mm. in diameter; peristome single, short, teeth 16 ..... *Hydropogon*

Cauline leaves tristichous, spreading, plane, ecostate, entire, oblong, elliptical, obovate, or oblanceolate, 1.00–2.25 mm. long, 0.50–0.80 mm. wide; sporophytes cladocarpous, on stems or branches; capsule subcylindrical, 0.80–1.00 mm. long, 0.25–0.50 mm. in diameter; peristome none ..... *Hydropogonella*

Hydropogon Bridel

Hydropogon Bridel, Bryologia universa **1**: 769. 1826.
Grimmia Hooker, Musci exotici **1**: 2. 1818.
Dryptodon Bridel, Bryologia universa **1**: 205. 1826.
Pilotrichum, sect. 2 *Fontinalis*, according to C. Müller, Synopsis Muscorum Frondosorum **2**: 148. 1850.

Plants submerged, somewhat robust in general appearance but stems are thread-like and denuded or nearly so; leaves pentastichous, costate with a forked, short costa or ecostate, imbricate, concave, oval, ovate, or obovate, pellucid, median leaf cells hexagonal or rhomboidal; monoecious; female flowers at or near the ends of branches; male flowers very small, bud-like, sessile, near the female flowers; perigonial leaves imbricate, concave, ovate, apices acuminate; sporophytes pseudocladocarpous; perichaetia oval, at or near ends of branches, concealed among the leaves, perichaetial leaves imbricate, concave, oval, apices acuminate, margins occasionally entire but usually serrulate in upper portion of leaf; capsules immersed, sessile or nearly so; calyptra narrowly conical; urn very small, suboval, oval, or subcylindric; operculum very short conical, rostellate; annulus none; peristome simple, teeth 16, short; spores greenish or yellowish brown, smooth to very finely muricate. (The name has reference to the aquatic habitat of the plant and the common Spanish name, Barba de palo.)

Hydropogon fontinaloides (Hooker) Bridel

Hydropogon fontinaloides (Hooker) Bridel. Bryologia universa **1**: 770. 1826.
Grimmia fontinaloides Hooker. Musci exotici **1**: 2. 1818.

Dryptodon fontinaloides Bridel. Bryologia universa **1**: 205. 1826.
Pilotrichum fontinaloides C. Müller. Synopsis Muscorum frondosorum **2**: 151. 1850.
Hydropogon brevinerve Hampe. Flora **64**: 379. 1881.

Plants submerged, slightly robust in general appearance because of the numerous, close, short branches, slightly flaccid to somewhat rigid, dull green, grayish green, or brownish green; stems reddish brown to purplish black, thread-like, commonly 5–20 cms. in length, occasionally up to 30 cms. long, and 0.13 mm.–0.25 mm. in diameter, somewhat denuded above, commonly denuded below, pinnately divided, appearing to be regularly so, branches spreading to erect-spreading, club-shaped, ends of branches usually truncate or obtuse, occasionally acute, upper branches short, up to 1.5 cm. in length, lower branches up to 2.5 cm. long; leaves usually rather firm, occasionally flaccid, pentastichous, ecostate or costate at the base with an unequally forked, short nerve, the longer portion of the nerve sometimes extending through approximately one-fourth of the leaf, cauline leaves loosely erect-imbricate, up to 2.00 mm. apart, branch leaves closely erect-imbricate, up to 0.25 mm. apart, plane to concave, oval, ovate, oblong, or obovate, abruptly contracted at apex into a short acumen, margins usually serrulate in upper portion of leaf, the serration frequently extending well toward the base, sometimes entire or very slightly serrulate, margins of branch leaves frequently revolute, those of cauline leaves rarely revolute, 2.0–3.0 mm. long, 0.75–1.35 mm. wide, 1.5–2.5 : 1; leaf cells pellucid, median cells hexagonal to rhomboidal, 8.5–15.0 μ wide, 5–8 : 1; alar cells not conspicuous, somewhat enlarged, quadrate, rectangular, or subhexagonal, yellowish or brownish, occasionally hyaline, not forming auricles; monoecious; male flowers very small, approximately 0.35 mm. wide and 0.40 mm. long, bud-like, near the perichaetia; perigonial leaves imbricate, concave, ovate, apices acuminate, margins usually entire, occasionally serrulate; sporophytes pseudocladocarpous; perichaetia oval, at or near ends of branches, concealed among the leaves, usually in groups of 2, 3, or 4, occasionally single; perichaetial leaves imbricate, concave, suboval, oval, or subovate to lanceolate, ecostate, apices long acuminate, margins commonly serrulate in upper portion of leaf, occasionally entire, plane, involute, or revolute, median cells linear attenuate or linear rhomboidal; calyptra narrowly conical, acuminate, covering only the beak of the operculum, 0.15–0.20 mm. in diameter, 0.40–0.50 mm. in length; capsules sessile or nearly so, seta approximately 0.075 mm. long, immersed, yellowish or yellowish brown when mature, suboval, oval, or subcylindrical, occasionally very slightly contracted beneath the mouth when dry, very small, 0.50–0.75 mm. in length, 0.25–0.60 mm. in diameter; operculum convex or short conical when young, 0.20–0.45 mm. in diameter, approximately 0.20 mm. in length, plane with age, rostellate, beak oblique; annulus none; peristome single, yellowish to subhyaline, short, teeth 16, 90.0–127.5 μ in length,

long triangular to lanceolate, apices obtuse, smooth, lamellae 10–20, very close; spores greenish or yellowish brown, commonly smooth, occasionally slightly muricate, 18.5–30.5 μ in diameter.

Type: not formerly designated. The plants, in fruit, of *Grimmia fontinaloides* of Herbarium Hookerianum in the Herbarium of the Royal Gardens, Kew, England, collected by M. de Humboldt,[5] marked *H. 2694*,[6] accompanied by W. Wilson's drawings, has been selected to represent the type. In the Herbarium of the British Museum of Natural History, London, there are other plants of *Grimmia fontinaloides* Hooker, *H. 2694*, and additional drawings by W. Wilson, from the Herb. Musc. W. Wilson. Two of the packets are marked "*H. 2694*, original spec., *Grimmia fontinaloides* Hook. Musc. Exot. t. 2, M. de Humboldt." These plants are considered to be a part of the type collection. Since Hooker first described the species and since his herbarium is in the Royal Gardens, Kew, the Kew plants were selected to represent the type in the absence of any specimens so marked.

The collection by Humboldt from Venezuela, South America, in the Herbarium of William Mitten, in The New York Botanical Garden, is marked TYPE; collected in Orinoco River, San Fernando, as *Grimmia fontinaloides*. This has been interpreted to mean that Mitten had received a portion of the collection upon which the type description had been based and that Mitten marked the material in this manner to so indicate.

Type collectors: Humboldt and Bonpland.[5] Date is unknown.

Type locality: on bank of Orinoco River between Atures and San Fernando, Venezuela, South America.

Distribution: South America:—Brazil, French Guiana, and Venezuela; in water, attached to rocks, and to roots and branches of trees and shrubs.

Additional descriptions: Brotherus, V. F., in Engler, A. and Prantl, K., Die natürlichen Pflanzenfamilien 223. Lieferung: 724. 1905; Brotherus, V. F., in Engler, A. and Prantl, K., Die natürlichen Pflanzenfamilien. **II.** Band Musci (Laubmoose). 2. Hälfte: 56–57. 1925; Cardot, J., Monographie des Fontinalacées, p. 38. 1892; Hooker, W. J., Musci Exotici **2**: 9. 1820; Mitten, G., Journ. Linnean

[5] The collectors cited with the type description are Humboldt and Bonpland. On the herbarium sheets Humboldt is designated as the collector.

[6] It has been assumed that *H. 2694* specifies the plants which were used by Hooker for drawings with a corresponding number.

Soc. **12**: 449. 1869; Müller, C., Linnaea **17**: 598. 1843; Schwaegrichen, F., Supplementum 4: (pages not numbered). 1842.

Illustrations: Brotherus, V. F., in Engler, A. and Prantl, K., Die natürlichen Pflanzenfamilien. 223. Lieferung: *fig. 542.* 1905; Brotherus, V. F., in Engler, A. and Prantl, K., Die natürlichen Pflanzenfamilien. II. Band. Musci (Laubmoose). 2. Hälfte: *fig. 472.* 1925; Hooker, W. J., Musci Exotici **1**: *pl. 2.* 1818; Schwaegrichen, F., Supplementum 4: *pl. 307.* 1842.

Specimens examined:

BRAZIL. *Glaziou, M. 10217,* near Rio de Janeiro, Sept. 14, 1878, (B., BM., H., K., NY., PC.); *Martius,* Yapura River, (B., BM., K., NY., S.); *Schwacke, W. 155,* Ica River, October, 1877, (B., H.); *Spruce, R.,* Musci Amazonici et Andini *1309,* Negro River, (BM., BR., E., G-Bois., G-Del., H., K., NY., PC., S.), Musci Amazonici et Andini *1309,* and *1310,* Cassiquiare River and Negro River, (F., MICH., US.), Musci Amazonici et Andini *1310,* Negro River, (Paris label is Cassiquiare River), (BM., K., PC.), Musci Amazonici et Andini *1310 b,* Cassiquiare River and Negro River, (BM., G-Bois., G-Del., K.); *Traill, J. W. H.,* Purus River, (E., K.); Ule, E., Bryotheca brasiliensis *256,* Jurua River, Bom Fim, (H., K., NY., PC., S.), *2239,* Jurua River, September, 1900, (B., H.); *Wallis, Gustav,* Branco River, in 1869, (B.); Coll. and date unknown, Brasilia. Comm. Zuccarini, (US).

FRENCH GUIANA. *LePrieur 661,* in 1838, (BM., G-Del., H.), in 1838, (BM., PC.); *Léveillé,* Cayenne, (K., PC.); *Montagne, J.,* (Since on the Montagne labels no specific collector is given, "Hb. Montagne" is interpreted to mean that Montagne collected the plants.), (BM., BR., G-Bois., G-Del., H., K., NY., PC., S.).

GUIANA. *Wallis, Gustav,* Guiana, in 1868, (PC.).

VENEZUELA. *Humboldt,* Orinoco River between Atures and San Fernando, (B., BM., K., NY.); *Humboldt* and *Bonpland,* Orinoco River, (B.); *Spruce, R. 78,* Cassiquiare River, in 1854, (NY.), Musci Amazonici et Andini *1311,* Orinoco River between Atures and San Fernando, (BM., E., K., NY.).

Bridel (1826) in Bryologia Universa speaks of the plants now known as *Hydropogon fontinaloides* as being difficult to classify. He transfers them from *Grimmia* to *Dryptodon* and later places them in the new genus *Hydropogon.* C. Müller (1843) in Linnaea makes the new tribe, Hydropogoneae, which includes the genera *Hydropogon* Brid. and *Cryptangium* C. Müll., and explains that this tribe is near the tribe to which *Fontinalis* belongs, but differs in form and structure of leaves and in the inflorescence. G. Mitten (1869) in Musci austro-americani considers that *Hydropogon* consists of two species, *H. gymnostomum* and *H. fontinaloides.* Jaeger and Sauerbeck (1879 or 1880), Cardot (1892), and Brotherus (1905 and 1925) include the genus *Hydropogon* in the Fontinalaceae.

The author, however, is excluding *Hydropogon* from Fontinalaceae because the leaves are pentastichous instead of tristichous, not carinate or carinate-conduplicate as in *Brachelyma, Dichelyma,* and several

species and varieties of *Fontinalis*, ecostate or costate at base with an unequally forked, short nerve rather than ecostate as in *Fontinalis* and *Brachelyma* or with nerve percurrent or excurrent as in *Dichelyma*, with margins commonly serrulate in upper portion and with serrulation frequently extending well toward the base in contrast with margins generally entire except at apex in Fontinalaceae, the plants are monoecious instead of dioecious, the perichaetia are usually in groups of 2, 3, or 4 and are hidden among the leaves at or near ends of branches rather than single and exposed along stems or branches as in the Fontinalaceae, the margins of young perichaetial leaves are generally serrulate in upper portion in *Hydropogon* and entire in the Fontinalaceae, and the peristome is single, lacking the trellis-like inner portion characteristic of *Fontinalis*, *Dichelyma*, and *Brachyelyma*, a difference of primary importance.

Hydropogonella Cardot

Hydropogonella Cardot, Revue Bryologique **22**: 18. 1895.
Fontinalis Bruch and Schimper, Bryologia Europaea, Fasc. 16: 4. 1842.
Cryptangium C. Müller, Linnaea **17**: 599. 1843.
Pilotrichum C. Müller, Synopsis Muscorum Frondosorum **2**: 148. 1850.
Hydropogon Mitten, Journal Linnean Society **12**: 449. 1869.

Plants submerged, slender, delicate; leaves tristichous, ecostate, distant, plane or nearly so, oblong or elliptical, sometimes obovate to oblanceolate, pellucid, median cells hexagonal to rhomboidal, alar cells quadrate to rectangular, scarcely distinct, not forming auricles; monoecious; cladocarpous; female flowers at ends of special short branches; male flowers very small, bud-like, at base of perichaetial branches, perigonial leaves concave, oval, apices acuminate; perichaetium subcylindrical, perichaetial leaves imbricate, oblong-lanceolate, apices acuminate, margins entire; capsule immersed to emergent, subcylindrical; operculum plane when mature, rostellate; peristome none; calyptra conical; spores yellowish-green, smooth. (Cardot chose the name *Hydropogonella* to indicate relationship with *Hydropogon*.)

Hydropogonella gymnostoma (Bruch and Schimper) Cardot

Hydropogonella gymnostoma (Bruch and Schimper) Cardot. Revue Bryologique **22**: 18. 1895.
Fontinalis gymnostoma Bruch and Schimper. Bryologia Europaea, Fasc. 16: 4. 1842.
Cryptangium Schomburgkii C. Müller. Linnaea **17**: 599. 1843.

Pilotrichum gymnostomum C. Müller. Synopsis Muscorum Frondosorum **2**: 152. 1850.

Hydropogon gymnostomum Mitten. Journal Linnean Society **12**: 449. 1869.

Cryptangium gymnostomum (Bruch and Schimper) Cardot. Mém. Soc. Nat. Sci. Nat. & Math. Cherbourg **28**: 41. 1892.

Hydropogonella gymnostoma (Bruch and Schimper) Cardot, f. *obtusifolia* P. W. Richards, in Royal Botanic Gardens, Kew, Bull. Misc. Information, p. 327. 1934.

Plants submerged, slender, delicate, pale green; stems with rhizoids at some nodes, pale green, purplish with age, flaccid, up to 15 cm. in length and 0.25 mm. in diameter, usually leafy to base, occasionally somewhat denuded, irregularly pinnately divided, branches erect-spreading to spreading, obtuse, short, up to 1.00 cm. in length; leaves somewhat flaccid, tristichous, ecostate, distant, up to 0.75 mm. apart, imbricate only at ends of stems and branches, spreading, plane or nearly so, oblong or elliptical, sometimes obovate to oblanceolate, narrowing toward base, 1.00–2.25 mm. long, 0.50–0.80 mm. wide, 2.00–2.50 : 1, margins entire and plane, apices usually short-acuminate, frequently subobtuse or obtuse, occasionally subapiculate; leaf cells pellucid, median cells hexagonal to rhomboidal, 10.50–19.50 μ wide, 3–7 : 1, marginal row of quadrate to rectangular cells frequently conspicuous, apical cells 17.00–20.50 μ wide, 1.50–2.00 : 1, alar cells scarcely distinct, quadrate to rectangular, not forming auricles; monoecious; cladocarpous; male flowers minute, bud-like, at base of perichaetial branches, perigonial leaves concave, oval, apices acuminate; fertile branches up to 4.50 mm. in length; perichaetium subcylindrical, perichaetial leaves imbricate and sheathing the urn, plane to concave, oblong-lanceolate, 0.75–1.00 mm. long, approximately 0.25 mm. wide, margins entire, apices spreading, acuminate; calyptra conical, symmetrical, very slightly lacerate at base, covering upper portion of capsule; capsule pale green, sessile, immersed to emergent, urn subcylindrical, gradually narrower upward, frequently contracted beneath mouth when mature, 0.80–1.00 mm. in length, 0.25–0.50 mm. in diameter; operculum plane when mature, rostellate; annulus none; peristome none; spores yellowish green, smooth, 20.50–37.50 μ in diameter, mature in summer.

Type: not previously designated. In the absence of material so marked the writer has selected to represent the type the plants, in fruit, in the British Museum of Natural History, London, England, collected by Robert Hermann Schomburgk,[7] in 1837, in British Guiana, South America. This collection has been chosen because Robert H. Schomburgk was sent in 1834 by the Royal Society of Geography of London to direct an expedition, for three years, in the

[7] A. Lasègue, Musée Botanique de M. Benjamin Delessert. p. 216. 1843. Paris.

interior of British Guiana, and because of the information on the herbarium label, "*Fontinalis gymnostoma* Bruch and Schimper n. sp. This fine and highly curious species of *Fontinalis* is remarkable by its naked mouth and the great tenderness of all its parts. In Guiana. Legit Schomburgk! A! [S] 1837."

Type collector: Robert Hermann Schomburgk. 1837.

Type locality: British Guiana.

Distribution: South America:—Bolivia, Brazil, British Guiana, and Venezuela; submerged, attached to rock, wood, tree trunks, and branches of shrubs and small trees.

Additional Descriptions: Brotherus, V. F., in Engler, A. and Prantl, K., Die natürlichen Pflanzenfamilien. 223. Lieferung: 725. 1905; Brotherus, V. F., in Engler, A. and Prantl, K., Die natürlichen Pflanzenfamilien. II. Band. Musci (Laubmoose). 2. Hälfte: 57. 1925.

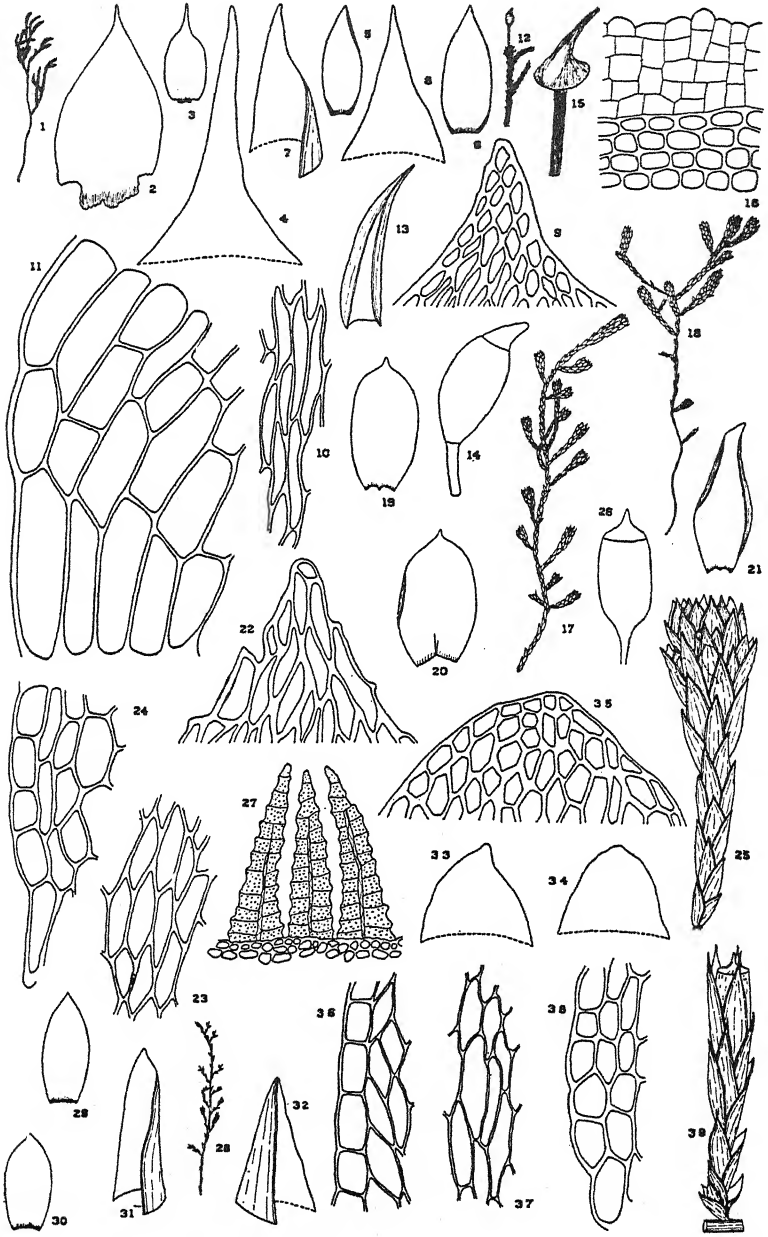
Illustrations: Brotherus, V. F., in Engler, A. and Prantl, K., Die natürlichen Pflanzenfamilien. 223. Lieferung: *fig. 543.* 1905; Brotherus, V. F., in Engler, A. and Prantl, K., Die natürlichen Pflanzenfamilien. II. Band. Musci (Laubmoose). 2. Hälfte: *fig. 473.* 1925; Bruch, Ph., Schimper, W. Ph., and Gumbel, Th., Bryologia Europaea, Fasc. 16: *pl. 428* or I. 1842; Richards, P. W., Royal Botanic Gardens, Kew, Bull. Misc. Information, p. 327, *fig. 4.* 1934.

Specimens examined:[8]

EXPLANATION OF FIGURES

Figs. 1–39. WARDIA HYGROMETRICA. 1. Plant, × ⅔. 2. Cauline leaf without the conspicuous alar groups, × 17.3. (When leaf is removed the alar cells commonly remain attached to stem instead of blade.) 3. Basal cauline leaf minus alar groups, × 8.3. 4. Apex of basal cauline leaf, × 52. 5–6. Branch leaves, × 8.3. 7–8. Apices of branch leaves, × 52. 9. Leaf cells, apical, × 218. 10. Leaf cells, median, × 218. 11. Leaf cells, alar, × 218. 12. Sporophyte and portion of gametophyte, × ⅔. 13. Calyptra (copied from Engler & Prantl), × 10. 14. Capsule and upper portion of seta (copied from Engler & Prantl), × 5.3. 15. Operculum and columella, × 8.3. 16. Portion of urn and rudimentary peristome, × 218. HYDROPOGON FONTINALOIDES. 17. Portion of plant (copied from Engler & Prantl), × ⅔. 18. Portion of plant, × ⅔. 19–20. Cauline leaves, × 8.3. 21. Branch leaf, × 8.3. 22. Leaf cells, apical, × 218. 23. Leaf cells, median, × 218. 24. Leaf cells, alar, × 218. 25. Branch of gametophyte bearing sporophytes (copied from Engler & Prantl), × 4.6. 26. Capsule and portion of seta (copied from Engler & Prantl), × 5.3. 27. Portion of peristome and urn (copied from Engler & Prantl), × 200. HYDROPOGONELLA GYMNOSTOMA. 28. Portion of plant, × ⅔. 29–30. Cauline leaves, × 8.3. 31–34. Leaf apices from same plant, × 52. 35. Leaf cells, apical, × 218. 36. Leaf cells, marginal, × 218. 37. Leaf cells, median, × 218. 38. Leaf cells, alar, × 218. 39. Fruiting branch, perichaetium, and capsule (copied from Bryologia Europaea), enlarged.

[8] In the herbaria at Kew and Paris, fruiting plants were examined which are *Hydropogonella gymnostoma* (Br. & Sch.) Cardot, under the following label: "*Fontinalis gymnostoma* Bryol. Eur. In montibus altioris. Virginia. Leg. A. Gray and J. Carey. Julio. 1841." "Schip." is written in lower left corner of the Kew sheet. The label is written in ink. The author believes that an error has occurred and that it is very doubtful that these plants were collected in Virginia.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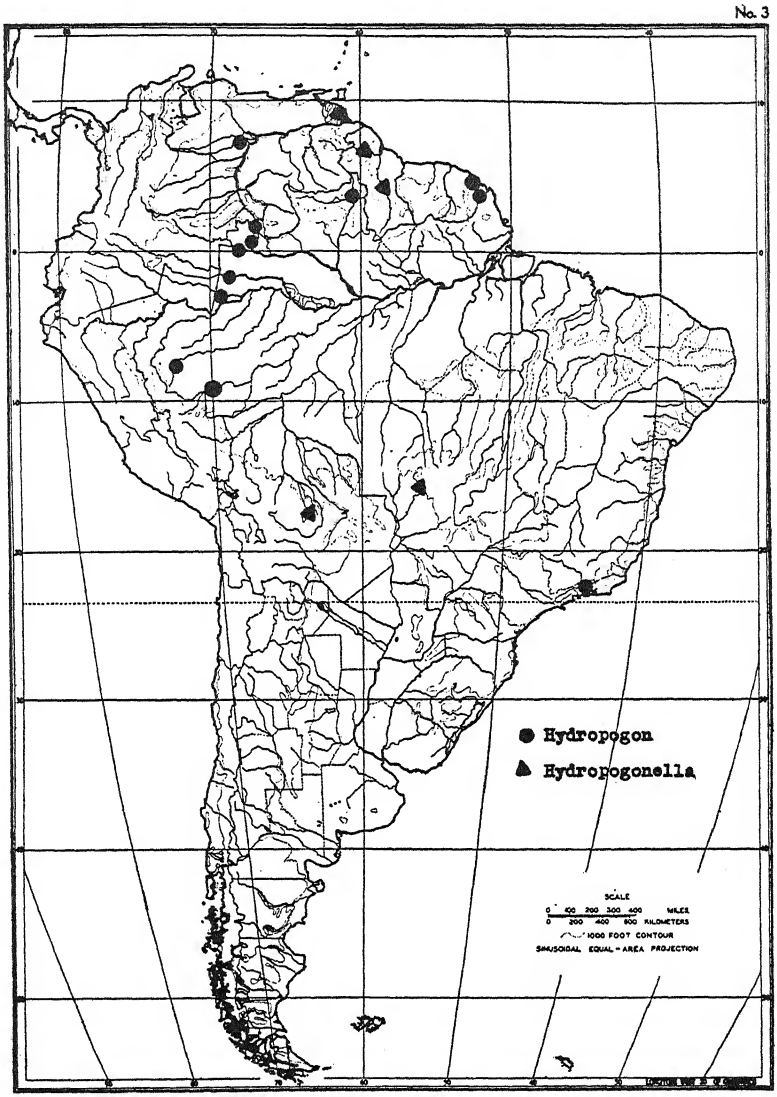
BOLIVIA. *Herzog, Th. 121*, August, 1907, (L.).
BRAZIL. *Lindman, C. A. 403*, Matto Grosso, in Sangrador River, near Cuyaba, Dec. 8, 1893, (B., H.), *B. 403*, Matto Grosso, in Sangrador River, near Cuyaba, Dec. 8, 1893, (S.).
BRITISH GUIANA. *Richards, P. W. 845*, bright green masses hanging in thin sheets from branches and small trees on rocky islets in Cuyuni River, Camaria Falls, in 1929, (CGE., DPU., NY.); *Schomburgk, R. H.*, A! [S] 1837, (BM.), *s. n. d.*, (B., BM., H., K., NY., PC., S.).
VENEZUELA. *Rusby, H. H. 452*, Delta of the Orinoco River, near Manaos, April and May, 1896, (NY.), April and May, 1896, Delta of the Orinoco River, near Manaos, (B., BM., G-Bois., H., K., NY., PC., S.), Delta of Orinoco River near Manaos, August, 1896, (FH.); *Rusby, H. H.* and *Squires 452*, Orinoco River, in 1896, (K., MICH.).

Bruch and Schimper (1842) in Bryologia Europaea state that *Fontinalis gymnostoma* is not a *Fontinalis* and that it belongs to a family not yet exactly determined. C. Müller (1843) in Linnaea forms a new tribe, Hydropogoneae, to include *Cryptangium* C. Müll. and *Hydropogon* Brid. Although he considers Hydropogoneae to be near the tribe to which *Fontinalis* belongs, Müller explains that these groups differ in the inflorescence and in the shape and structure of the leaves. G. Mitten (1869) in Musci austro-americani states that there are two species in *Hydropogon*, *H. gymnostomum* and *H. fontinaloides*. Jaeger and Sauerbeck (1879 or 1880), Cardot (1892), and Brotherus (1905 and 1925) include *Hydropogonella* in the Fontinalaceae.

The writer, however, does not consider this genus to belong to the Fontinalaceae because the plants of *Hydropogonella* are much more delicate in habit than those of *Fontinalis*, *Dichelyma*, and *Brachelyma*, the stems are usually leafy to the base instead of commonly denuded as in Fontinalaceae especially with age, the leaves are not carinate or carinate-conduplicate as in *Brachelyma*, *Dichelyma*, and several species and varieties of *Fontinalis*, the leaf cells are hexagonal to rhomboidal and have nearly the same appearance throughout the leaf rather than somewhat linear and different in shape at apex, base, and middle of blade as is commonly true in the Fontinalaceae, the leaf apices are entire instead of slightly denticulate as is general in *Fontinalis*, *Dichelyma*, and *Brachelyma*, the marginal row of cells is frequently conspicuous rather than similar to adjacent cells as in Fontinalaceae, the plants are monoecious instead of dioecious, and the peristome is absent, a striking contrast with the well developed peristome of 16 teeth and the trellis-like union of cilia in the Fontinalaceae.

ALPHABETICAL LIST OF COLLECTORS AND EXSICCATI

All specimens cited have been examined by the author. The



Map 1. Distribution of *Hydropogon* and *Hydropogonella* according to labels on specimens examined by author. The locations are approximate when exact locality information is not available. If country only is known the indicator is in the center of that country on the map. (South America, No. 3, prepared by J. Paul Goode and published by the University of Chicago Press.)

specific names are not repeated since each genus has only one species. The mosses included are *Hydropogon fontinaloides* (Hooker) Bridel, *Hydropogonella gymnostoma* (Bruch and Schimper) Cardot, and *Wardia hygrometrica* Harvey and Hooker. The year of collection, in parentheses, has been used in citing specimens for which no collector's number was available. The letters *s. n. d.* indicate that neither a number nor a date were included on the label.

Bergius
s. n. d. Wardia
Breutel
s. n. d. Wardia
Burchell
6995 Wardia
Ecklon, C. F.
91 Wardia
(1825) Wardia
Ecklon & Zeyher
(1847) Wardia
Garside, S.
79 Wardia
Glaziou, M.
10217 Hydropogon
Greville, Dr.
s. n. d. Wardia
Harvey, W. H.
(1834) Wardia
(1837) Wardia
s. n. d. Wardia
Herzog, Th.
121 Hydropogonella
Hey
5 Wardia
(1925) Wardia
Humboldt
s. n. d. Hydropogon
Humboldt & Bonpland
s. n. d. Hydropogon
Jelinek
s. n. d. Wardia
Leprieur
661 Hydropogon
(1838) Hydropogon
s. n. d. Hydropogon
Léveillé
s. n. d. Hydropogon
Lindman, C. A.
403 Hydropogonella
B 403 Hydropogonella
Mac Gillivray, John
(1852) Wardia
Mac Owan
72 Wardia
s. n. d. Wardia
Martius
s. n. d. Hydropogon
Montagne, J.
s. n. d. Hydropogon
Pillans, N. S.
4076 Wardia
Rehmann, Dr. A.
302 Wardia
(1875–77) Wardia
Richards, P. W.
845 Hydropogonella
Roser, Dr.
(1854) Wardia
Rusby, H. H.
452 Hydropogonella
(1896) Hydropogonella
Rusby & Squires
452 Hydropogonella
Schomburgk, R. H.
(1837) Hydropogonella
s. n. d. Hydropogonella
Schwacke, W.
155 Hydropogon
s. n. d. Hydropogon
Sprengel
s. n. d. Wardia
Spruce, R.
78 Hydropogon
1309 Hydropogon
1310 Hydropogon
1310 b Hydropogon
1311 Hydropogon
s. n. d. Hydropogon
Traill, J. W. H.
s. n. d. Hydropogon
Ule, E.
256 Hydropogon
2239 Hydropogon
Wager, H. A.
8 Wardia
93 Wardia
343 Wardia
Wallis, Gustav
(1868) Hydropogon
(1869) Hydropogon
Ward, N. B.
(1838) Wardia
Zeyher
s. n. d. Wardia

ABBREVIATIONS FOR HERBARIA CITED

The symbols, with the exception of Dixon, are according to the Chronica Botanica standardized herbarium abbreviations.[9]

B. Botanisches Museum, Berlin-Dahlem, Germany.
BM. Department of Botany of the British Museum of Natural History, London, England.
BR. Jardin Botanique de l'État, Brussels, Belgium.
CGE. Botanical Museum and Herbarium of the University, Botany School, Cambridge, England.
Dixon. Herbarium of H. N. Dixon, 17 St. Matthew's Parade, Northampton, England.
DPU. Herbarium of DePauw University, Greencastle, Indiana.
E. Royal Botanic Garden, Edinburgh, Scotland.
F. Field Museum of Natural History, Chicago, Illinois.
FH. Farlow Reference Library and Herbarium of Cryptogamic Botany, Cambridge, Massachusetts.
G-Bois. Institut de botanique systématique de l'Université, Herbier Boissier, Geneva, Switzerland.
G-Del. Institut de botanique systématique de l'Université, Herbier Delessert, Geneva, Switzerland.
H. Botanisches Museum der Universität, Helsingfors, Finland.
K. Herbarium, Royal Botanic Gardens, Kew, England.
L. Rijksherbarium, Leiden, Holland.
MICH. Herbarium of University of Michigan, Ann Arbor, Michigan.
NY. New York Botanical Garden, New York, New York.
PC. Laboratoire de Cryptogamie, Museum d'Histoire Naturelle, Paris, France.
S. Naturhistoriska Riksmuseet, Stockholm, Sweden.
US. U. S. National Herbarium, Smithsonian Institution, Washington, D. C.
WELC. Botany Department, Wellesley College, Wellesley, Massachusetts.

INDEX OF SYNONYMS

Cryptangium gymnostomum (Bruch and Schimper) Cardot = *Hydropogonella gymnostoma* (Bruch and Schimper) Cardot.
Cryptangium Schomburgkii C. Müller = *Hydropogonella gymnostoma* (Bruch & Schimper) Cardot).
Dryptodon fontinaloides Bridel = *Hydropogon fontinaloides* (Hooker) Bridel.
Fontinalis gymnostoma Bruch & Schimper = *Hydropogonella gymnostoma* (Bruch & Schimper) Cardot.
Grimmia fontinaloides Hooker = *Hydropogon fontinaloides* (Hooker) Bridel.
Hydropogon brevinerve Hampe = *Hydropogon fontinaloides* (Hooker) Bridel.
Hydropogon gymnostomum Mitten = *Hydropogonella gymnostoma* (Bruch & Schimper) Cardot.
Hydropogonella gymnostoma (Bruch & Schimper) Cardot, f. *obtusifolia* P. W. Richards = *Hydropogonella gymnostoma* (Bruch & Schimper) Cardot.
Neckera hygrometrica C. Müller = *Wardia hygrometrica* Harvey and Hooker.
Pilotrichum fontinaloides C. Müller = *Hydropogon fontinaloides* (Hooker) Bridel.
Pilotrichum gymnostomum C. Müller = *Hydropogonella gymnostoma* (Bruch & Schimper) Cardot.

[9] Lanjouw, J. On the standardization of herbarium abbreviations. Chronica Botanica 3: 345–348. 1937, 5: 143–150. 1939.

ACKNOWLEDGMENTS

The author is very greatly indebted to the American Philosophical Society for a research grant from the Penrose Fund which made possible the continuation of research concerning the Fontinalaceae in European herbaria and libraries.

A grant from the Graduate Council of DePauw University has aided in the publication of this paper. The completion of the research has been possible through the use of the necessary laboratory equipment and library facilities of the Botany Department of DePauw University.

A grant from the American Association for the Advancement of Science through the Indiana Academy of Science has secured the services of the artist, Dr. William D. Gray, a graduate in Botany from DePauw University, to whom I am most sincerely thankful for splendid cooperation, care, accuracy, and skill in the preparation of the drawings.

To E. B. Bartram, Bushkill, Pennsylvania, H. S. Conard, Grinnell College, H. N. Dixon, Northampton, England, A. J. Grout, Honorary Curator of the Moss Herbarium of the New York Botanical Garden, P. W. Richards, Cambridge University, A. J. Sharp, University of Tennessee, Wm. C. Steere, University of Michigan, and to Fr. Verdoorn, Research Associate of Harvard University, the writer is especially grateful for many helpful suggestions. To T. G. Yuncker, DePauw University, I owe a debt of gratitude for consultation on the nomenclature and for criticism of the manuscript. Miss Dade B. Shearer, Professor Emerita of Latin, DePauw University, very willingly aided in the preparation of the Latin descriptions.

For the privilege of the examination of specimens in the herbaria cited the author is very appreciative and wishes to express thanks to the curators who so kindly made the collections available for study.

Acknowledgments are also extended to J. Christian Bay, Librarian, The John Crerar Library, Nell C. Horner, Librarian, Missouri Botanical Garden, Theodor Just, Professor of Botany, University of Notre Dame, Fr. Verdoorn, Waltham, Massachusetts, and to Frances E. Wynne, The New York Botanical Garden, for locating or verifying data in obscure publications in their libraries.

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PARMELIA STYGIA (L.) ACH. IN NEW JERSEY

JOHN W. THOMSON, JR.

On May 19, 1940, on one of the field trips of the Branchville Conferences of the Torrey Botanical Club a shining, dark brown foliose lichen was collected in the Stokes State Forest area in Sussex County, New Jersey. This specimen has been determined by Dr. E. C. Berry to be *Parmelia stygia* (L.) Ach. In his monograph (1) Dr. Berry gives the range of this species as being Newfoundland to New York, west to Alberta and Washington. Collections in New England are from Maine, New Hampshire, Vermont, and in the Adirondack Mts. in New York so that this collection may be compared with the occurrence of *Cetraria islandica* in New Jersey as given by Torrey (2). It is an alpine and northern lichen which in favorable localities may be expected southward in the eastern mountains. The specimen was collected on a quartzite ledge on the north side of Sunrise Mt. at a little less than 1,600 feet altitude. It grew in a fairly large area, several feet across, on the lower, moister portion of the ledge, shaded by trees and shrubs. A specimen has been deposited in the herbarium of the New York Botanical Garden; another is in the private herbarium of the writer.

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THE DISTRIBUTION OF TORTULA PAGORUM (MILDE) DE NOT. IN NORTH AMERICA

LEWIS E. ANDERSON

Few bryogeographic studies have been made in North America. The studies of Conard (1932),[1] Steere (1937),[2] Anderson (1938),[3] Sharp (1939)[4] and others deal with geographical affinities of bryophytes occurring within more or less specific physiographic regions. In order to determine North American ranges of species, these authors have had to rely mostly upon herbarium records and published reports. As only a few regions have been studied intensively, distributional maps of the less common and usually more interesting species frequently reveal disjunct and ill-defined ranges which are difficult to interpret. The disjunct ranges assigned to many species are often misleading and in a few cases probably entirely false. Insufficient collecting over large and critical geographical areas is responsible for many of these distributional anomalies. On the other hand, there are many species which actually are restricted or disjunct in their ranges. It is, therefore, difficult to interpret distributional maps when so many regions are relatively unexplored bryologically. Thus, wherever possible, the distribution of species should be studied individually with field studies directed toward the determination of actual specific ranges. The present paper represents an attempt to do this for one of the species of bryophytes whose distribution has been puzzling and uncertain.

Tortula pagorum (Milde) DeNot. is one of the group of Tortulae which produces propagula and is usually corticolous, although frequently it is found also on rocks. It is distinct from the other corticolous, propaguliferous Tortulae, viz., *T. papillosa, T. caroliniana,* and *T. propagulosa* in that the propagula are produced in the axils of the upper leaves and at the apex of the stem, but not on the costa or surface of the leaves as in these species. Superficially *T. pagorum* resembles *T. papillosa,* with which it is easily confused unless the position of the propagula is observed carefully. In addition, the leaf cells of *T. pagorum* are multipapillose, but unipapillose in *T. papillosa.* When the plants are moist the two species are easily distinguished

[1] Proc. Iowa Acad. Sci. 39: 57–61.
[2] Rhodora 39: 1–14; Ecology 18: 346–358; Ann. Bryol. 11: 145–152.
[3] The Bryologist 41: 1–11.
[4] Amer. Mid. Nat. 21: 267–354.

macroscopically. In *T. pagorum* the numerous propagula form a conspicuous dark-green, mealy-appearing patch in the center of a distinct terminal rosette of leaves. This appearance is absent in *T. papillosa*, the propagula being more or less hidden in the axils of the leaves. In both species, however, the leaves are incurved and closely and tightly appressed when dry. In this condition they are almost indistinguishable to the unaided eye.

The taxonomic status of *T. pagorum*, as Steere (1940)[5] points out, has been much debated. It was described by Milde in 1861,[6] from the village of Meran, in the south Tyrol of Switzerland. DeNotaris transferred it from the genus Barbula to Tortula in 1869.[7] Amann (1912)[8] thought it was probably only a form of *T. alpina* var. *inermis*. Limpricht (1888)[9] likewise considered *T. pagorum* a form of *T. alpina* var. *propagulifera*. Lindberg (1864),[10] Correns (1899),[11] and others, however, treated *T. pagorum* variously as forms of *T. laevipila*. Loeske (1931)[12] believed it to be similar to *T. laevipilaeformis*. These differences of opinion centered mainly around the question of inflorescence, the nature of which remained in doubt for a number of years. Both Roth (1904)[13] and Limpricht (*op. cit.*) erroneously described it as monoicous, for it is now known to be dioicous.

Archegonial plants are common in this country, but antheridial plants are unknown except in Europe.[14] Reproduction is entirely through propagula, which are normally produced in tremendous quantities. Sporophytes are completely unknown. *T. laevipila*, *T.*

[5] Moss Flora of N. A. **1**: 228–246; The Bryologist **43**: 98–109.
[6] Bot. Zeit. **20**: 469.
[7] Epil. Briol. Ital. 542.
[8] Flora d. Mousses de la Suisse. 117.
[9] Laubm. **1**: 683.
[10] Öfvers. K. Vetensk.-Akad. Förh. **21**: 245.
[11] Untersuchungen über die Vermehrung der Laubmoose durch Brutorgane und Stecklinge. Jena.
[12] Boll. Soc. Ticinese Sci. Nat. **1933**: 1–11.
[13] Laubm. **1**: 361.
[14] In this connection it might not be amiss to report an experience which Professor A. J. Sharp and the writer had in 1937. On December 19, the writer, while driving through western Tennessee, discovered *Tortula pagorum* growing abundantly on trees in several towns. Later that day these collections were shown to Professor Sharp of the University of Tennessee. Upon closer examination of these collections a number of plants appeared to have young sporophytes. Enclosed in the terminal rosette of these "fruiting" plants was a small, shining, pale green, sub-globose body which resembled superficially a young sessile capsule. Dissection of these bodies, however, revealed no evidence of capsular structure, and it was finally decided that they bore no relation to sporophytes. Positive identification of these bodies has not been made, but Professor H. L. Blomquist later concluded, after a somewhat detailed study, that they are probably galls which are the result of fungus or insect activity.

alpina, and *T. laevipilaeformis* are all monoicous. The dioicous inflorescence combined with the well-defined differences in propagula now appear sufficient for most taxonomists to treat *T. pagorum* as a distinct species (see Jaeggli, 1933[15] and Steere, 1940, *op. cit.*).

The first collection of *T. pagorum* in North America was made in Augusta, Georgia, by John K. Small, in 1895. The specimen was labelled *Barbula papillosa* and was issued as No. 39, of his "*Mosses of the Southern United States.*" Its true identity remained unknown until a specimen was examined by Grout during the preparation of his "*Mosses with Hand-lens and Microscope,*" and subsequently Grout (1904)[16] published the first report of its occurrence in this country.[17]

Grout pointed out the difference in the position of propagula in the two species and predicted a northern distribution for *T. pagorum.* The second collection was made in 1916 on the Pacific Coast, where Ruth Thornburg found it on elm trees on the campus of the University of California, Berkeley. Holzinger issued this material as No. 360 of his *Exsiccati, Musci Acrocarpi Boreali Americana.* Beals next found it in 1919 on both the West Virginia and Maryland sides of Harpers Ferry, and published (1920)[18] a note in which he included excellent photomicrographs of leaves and propagula. Beals' station still represents the northeastern limit of its range as known at present. Subsequent collections were even more sporadic and more widely separated geographically. In 1923, Bartram collected archegonial plants in the Patagonia Mountains of Arizona and Holzinger issued them as No. 500 of his exsiccati. This was the first collection of archegonial plants in North America. Bartram later (1929)[19] discovered *T. pagorum* among Orcutt's collections from western Texas, in the general vicinity of Alpine, Brewster County and Fort Davis, Jeff Davis County, in western Texas and the following year Blomquist (1930)[20] found it in two places in North Carolina: Durham, Durham County and Raleigh, Wake County. Blomquist's article contains excellent illustrations of archegonia. Sharp (1930)[21] in a survey of the mosses of Oklahoma, reported it from two places in that state and he later found it in abun-

[15] Boll. Soc. Ticinese Sci. Nat. **1933**: 11.

[16] The Bryologist **7**: 65.

[17] This collection was erroneously recorded by Grout (*l. c.*) from "Atlanta, Georgia." The label on Small's No. 39, however, clearly reads "Augusta, Georgia." It has since been authentically collected in Atlanta.

[18] The Bryologist **23**: 33–36.

[19] Bull. Torrey Bot. Club **51**: 335–340.

[20] The Bryologist **33**: 41–43.

[21] The Bryologist **33**: 45–55.

dance in Knoxville, Tennessee. Since the inception of the present study in 1936 a number of collections have been made in various scattered localities.[22]

Most writers, in reporting the occurrence of *T. pagorum*, have brought out two striking facts. First, in spite of its infrequency it usually grows abundantly and in well-developed colonies wherever it is found. Miss Thornburg discovered it on numerous elms on the campus of the University of California and reported that it formed extensive mats there. Beals (*op. cit.*) found a "considerable quantity" at Harpers Ferry, and Miss Levy, according to Beals, during a later visit there, found "many trees and ledges" with growths of *T. pagorum*. Blomquist (*op. cit.*) found numerous well-developed colonies in Raleigh, North Carolina, and stated that in Durham ". . . it appears to be quite common on trees, especially on elm." He found it to be so common in Durham, in fact, that be expressed astonishment at not having noticed it before since he had ". . . made collections from time to time of tree mosses on the campus [of Duke University] and on identical trees upon which it occurs." The second fact which these authors emphasize is that in the eastern part of its range *T. pagorum* appears to grow only in towns or near human habitation. Predominantly, east of the Mississippi, it is a moss of street and park trees and rarely grows outside the immediate environs of cities, towns, villages, and farm houses. This fact caused Sharp (1939)[23] to ". . . doubt whether *Tortula pagorum* is native in eastern United States." According to him ". . . the fact that it is found only near habitation makes it appear adventive." Apparently these same habitation restrictions apply to European plants. The type locality is in the village of Meran, and Loeske (*op. cit.*) states that in the village of Bellingova it is the characteristic moss of "Strassen und Parkbäumen." He further adds "Es ist hinsichtlich der Baumarten nicht wählerisch, ..." Wachter's specimens are from street trees in Villenhove, Holland. Whether it grows in Europe away from habitation cannot be determined at present. European correspondents and herbaria are, of course, inaccessible. Several collections from southern England are known, but it is impossible to determine from the literature whether they are from urban habitats.

[22] Three localities in Ohio, by Bartley and Pontius (comm. Wareham); Georgia, by McVaugh and Pyron; South Carolina and Virginia, by Correll and Correll; Texas, by Sharp; and Indiana, by Welch.

[23] Amer. Mid. Nat. 21: 267–354.

In southwestern United States, these habitat conditions are completely reversed. Bartram (1924)[24] comments as follows concerning *T. pagorum* in southern Arizona: "In this arid country the collections from shaded ledges below 4000 ft., in the treeless foothills, are naturally xerophytic types, somewhat dwarfed and reduced in every way. As one works up the canyons into the oak belt above 4500 ft., the plants become more typical and at 6000 ft. or above, where moisture and shade are not lacking, the collections, in part at least, approach closely to the typical form of the species."[25] No specific comment is made concerning the habitat range of Orcutt's specimens from Texas, but the collections were made ". . . at altitudes of approximately 5000–6000 feet." Other species in the Orcutt collection do not suggest that the collections were made near habitation, and Sharp's material from southwestern Oklahoma was likewise not collected near habitation. Evidently, therefore, there is a somewhat restricted area in the southwestern United States where *T. pagorum* comprises a natural element of the moss flora.

To understand more fully the distributional features of *T. pagorum*, it was necessary to obtain more complete information concerning its actual range and to compile careful observations concerning its habitat restrictions. Since 1937, therefore, the writer has sought to obtain as detailed distributional data as possible. It has been possible to conduct extensive field studies over a large part of the eastern United States because it proved to be restricted entirely to towns and cities. Motor trips to various points during the normal course of travel were

[24] Bull. Torrey Bot. Club 51: 335–340.

[25] These remarks concerned plants which Bartram referred to *Tortula alpina* (Bry. eur.) Bruch. Similar plants bearing abundant and characteristic propagula were referred to *T. alpina* var. *propagulifera* Limpr. (synonomous with *T. pagorum*). Some of these plants referred to *T. alpina* represent nothing more than plants of *T. pagorum* which lack propagula (viz., Holz. Musc. Ac. Bor. Am. No. 500 and Bartr. Mosses of So. Arizona No. 15), but others, particularly at lower altitudes, possess " . . . reduced leaves, broadly obtuse or emarginate at the apex . . . " and a strongly toothed excurrent spinulose-papillose costa. Steere (*l. c.*) clarified the situation by describing a new species, *T. Bartramii*, which separated these puzzling forms from *T. pagorum*. *T. Bartramii* resembles *T. pagorum* in many respects and they should not be confused. In *T. Bartramii* the costa is strongly spinulose-papillose on the back and strongly toothed along the excurrent part whereas the costa of *T. pagorum* is smooth on the back with a smooth or slightly roughened awn. In addition the leaf cells of *T. Bartramii* are much more densely papillose and more obscure than in *T. pagorum*. Apparently, the latter grows at somewhat higher altitudes and mostly on tree trunks while *T. Bartramii* is more prevalent in the foothills and at lower altitudes and is principally or entirely confined to earth and rock substrata on shaded ledges (*in litt.* Bartram). Apparently the two species have practically the same range in Arizona.

thus utilized and a practice was made of stopping in towns or other favorable places en route to conduct searches for *T. pagorum*. In regions where it is abundant, this practice resulted in only a few minutes' delay, as it was evident usually on the first elm tree examined well within the town. With more experience, it even became possible to locate its presence from an automobile driven at slow speeds and after a collection had been made an estimate of its abundance could then be obtained without further stops. At or near the limits of its range, however, more thorough searches were necessary. At many places time did not permit sufficiently thorough searches to locate it and more intensive collecting in such places will undoubtedly supplement the data presented in the present paper. Observations were made concerning its habitat relationships, its relative abundance, and its associations. Although these studies are not complete by any means, it seems desirable at the present time to present the information which has accumulated. It is hoped that these observations may stimulate bryologists located in various parts of the country to contribute additional data.

The distribution of *T. pagorum* as known at present is shown on the accompanying map. The known collections of *T. pagorum* are represented by a solid dot, previous collections having been incorporated with the writer's collections. In addition, each town or place in which an unsuccessful search for *T. pagorum* was made is represented on the map by a circle. This innovation makes it possible to detect regions where the absence of *T. pagorum* may be due to a lack of collecting. The employment of the two symbols is not intended to be definitive, for it is realized fully that it may grow in a number of localities where present searches were unsuccessful. It is well known that species frequently are overlooked in areas which have been collected intensively.[26] It can be assumed, however, that *T. pagorum* does not abound at the points on the map designated by circles and that at most of them it occurs only sparingly or not at all. North- and south-central Alabama illustrate regions where the absence of *T. pagorum* on the map may be attributed to a paucity of observations.

[26] This already has been demonstrated quite effectively. In 1938, the writer looked for *T. pagorum* at several places along the highway route through Hanover Jefferson County, Indiana. No trace of the moss could be found during this somewhat hurried search. Recently, however, Welch (*l. c.*), while examining material of the genus *Orthotrichum* for her "Studies of Indiana Bryophytes," discovered four collections of *T. pagorum* which she had made in Hanover in July, 1937. Other cases of this sort are expected to occur as more regions are studied bryologically.

The only region which has been studied in that state is along the east-west highway connecting Anniston and Birmingham with Columbus, Mississippi. Likewise, Missouri, Arkansas, eastern Oklahoma, and most of Texas have received little attention from bryologists. It is to be expected that *T. pagorum* occurs more or less abundantly in all of these states. The details of its southwestern and pacific coast distribution are also unknown for only a few bryologists have collected in these regions and their activities have been local and restricted. The observations presented in the present paper, therefore, are confined to that part of the United States east of the Mississippi River with the minor exceptions of a few observations in Arkansas, Iowa, Minnesota, Louisiana, and Wyoming.

Prior to the present study, only eight scattered localities for *T. pagorum* were known in the eastern United States. At the present time, approximately 154 stations are known, including a few collections contributed by other workers. It is confined to the region lying between 30° and 40° north latitude and its east-west range extends, as previously known, from the Atlantic to the Pacific coast. This is not in accord with Grout's (*l. c.*) prediction of a northern distribution but agrees with Nicholson's (1905)[27] expectation which was based upon its limited southern distribution in Europe.

It is obvious from the available data that *T. pagorum* reaches its maximum development in the region of the Piedmont Plateau. In this region it is one of the most common and most abundant mosses of urban trees. It has been collected in every county of the Piedmont of North Carolina, and few towns were visited in this region in which it did not grow profusely, forming extensive mats on the trunks of trees and occasionally on rock or brick walls. Apparently it is equally as abundant in the Piedmont of southern Virginia, South Carolina, and Georgia. It occurs with less regularity in Alabama and Tennessee and in northern Virginia and northeastern West Virginia it reaches the northeastern limit of its range. North of Petersburg, Virginia, it becomes increasingly rare and no trace of it could be found north of Fredericksburg. Several searches were conducted in Washington, D. C., as well as in Baltimore and Philadelphia, but none was successful. Many keen observers have collected extensively over a long period in the larger cities along the eastern seaboard and it is hardly likely that it has been overlooked.

[27] The Bryologist 8: 20.

In the Appalachian Mountains, *T. pagorum* is extremely rare, although it occurs abundantly on both sides of the range. Only three stations are known within the mountains, all in North Carolina: Asheville (2200 feet), Jefferson (3000 feet), and Old Fort (1900 feet). At each of these, only a few depauperate plants were found, and in no instance did they form mats or colonies of any appreciable size. Sharp, whose critical and keen observations have unearthed so many interesting and unusual bryophytic finds in the southern Appalachians, has been unable to locate *T. pagorum* in this region. His observations (*in litt.*) agree with those of the writer in that it is exceedingly limited at altitudes above 1800 feet. This is in sharp contrast to the situation in the western United States, where Bartram found *T. pagorum* growing profusely at altitudes of 5000 feet and above.

In the Coastal Plain, *T. pagorum* occurs sparingly and erratically. In some towns it is exceedingly abundant, producing well-developed colonies which form large and conspicuous mats on numerous trees. In other towns whose habitat conditions appear similar, there are only a few plants scattered in the crevices of the bark of one or two trees. In still others, it is entirely absent. No explanation is evident. As in the Piedmont, the presence of elms seems to be a factor, for towns in which elms are used in street and shade plantings almost invariably yield *T. pagorum*. It was collected in many towns, however, where no elms were noticed. It is interesting, also, to note that two of the best developed colonies in the Coastal Plain are within a few hundred yards of the ocean. One of these is on live oak in Southport, N. C., and the other on elms in the town of Manteo, N. C., on Roanoke Island. Other stations along the ocean occur as far south as Savannah, Georgia, where it was found sparingly. Attempts to find it in Brunswick, Georgia, and Jacksonville, Florida, were unsuccessful. In other coastal towns, such as Wilmington, N. C., Beaufort, S. C., and New Bern, N. C., it is apparently absent.

The southern limit of *T. pagorum* was determined with approximate accuracy only in Georgia. Its occurrence was checked in towns along five north-south highways in that state. They are U. S. route 17 (Savannah to Jacksonville, Florida); U. S. route 1 (Augusta to Jacksonville); Georgia state routes 24, 29, 31 and 89 (Eatonton, Milledgeville, Dublin, McRae, Homerville and Fargo); U. S. route 129 (Athens to Macon) and U. S. route 41 (Macon to Valdosta); and U. S.

route 19 (Atlanta to Thomasville). On each route *T. pagorum* becomes decreasingly abundant southward. As the limits of its range are approached, fewer trees support it and its growth is limited to a few plants in bark crevices. Well-developed colonies were not observed south of Atlanta, Athens, and Augusta. The southernmost points at which it was found are Savannah, Baxley, McRae, Cordele and Americus. Intensive searches south of these points may extend its southward range slightly, but it is believed that these points represent the approximate limits.

Attempts to locate *T. pagorum* along the Gulf of Mexico in Florida, Alabama, Mississippi and Louisiana were unsuccessful. Towns such as St. Petersburg, Tampa, and Pensacola, Florida; Mobile, Alabama; and Gulport and Biloxi, Mississippi were included in these searches. Curiously enough, however, it was found in limited quantity in Baton Rouge, Louisiana, as well as in the small but old town of Natchitoches, on the Red River, about 150 miles northwest of Baton Rouge. No stations are known between these two points and the Texas localities, but this area has been collected very inadequately.

The northernmost known station is in Circleville, Ohio, where Bartley and Pontius found it in 1937. Its northern limit actually must be in this general vicinity, for there have been many excellent collectors in Ohio, particularly in the vicinity of Columbus. It is not likely, therefore, that it has been overlooked. A sparse development of *T. pagorum* was found in McConnelsville, Ohio, but extensive searches farther north in the vicinity of Canton did not yield it. Recently, as previously stated, Welch has reported it from southern Indiana, and it might be expected to occur in southern Illinois.

Considerable effort was made to obtain information and observations concerning the supposed habitat restrictions of *T. pagorum*. Its restriction to towns and villages in the eastern United States has been suspected but no data have been available to support this view. Over 5000 collections of mosses have been made in North Carolina by the writer alone. Every county in the state has been explored to some extent and many have been visited repeatedly. Not a single collection of *T. pagorum* was made, however, that could not be attributed to some form of human habitation. This is true in spite of specific attempts to locate it in places isolated from human habitation. Similar, although less thorough, observations in other parts of the eastern United States indicate that *T. pagorum* is exceedingly rare and pos-

sibly non-existent in the native and undisturbed moss flora of this part of the country. Leslie and Pontius, presumably, found it removed from habitation in Ohio, although no mention was made of its proximity to farm houses or other human agencies. Ruby Williams, in an intensive plant survey of Pilot Mountain, North Carolina, found a few scrappy plants "several miles from a farm house." So far as known, these are the only stations in the east which are not in the immediate surroundings of human habitation. Occasionally it was found on elms located near isolated farm dwellings and in two instances it was collected near tobacco barns in the flue-curing tobacco region of North Carolina. This suggests that smoke may be a factor in promoting its establishment.

Many towns were observed and studied in which *T. pagorum* thins towards the outskirts and disappears entirely with the last houses. At first, this was believed to be due to the absence of elms beyond city limits, for it was frequently observed that *T. pagorum* extended only as far as the last elms. There are many exceptions, however, and trees other than elms support it near urban limits, notably species of oaks. An interesting situation illustrating its confinement to cities occurs in Charlotte, North Carolina, where a street of elms extends uninterruptedly from the interior of the city (along E. 7th Street and Hawthorne Lane) to a considerable distance beyond the city limits where there are no houses. Well within the city, where houses are numerous, the elms support extensive mats of *T. pagorum*. In the summer of 1939, with the aid of my colleague, Professor H. J. Oosting, elms were examined at successive intervals from a point in the city where the moss is abundant to the outskirts. *T. pagorum* was found to be less and less abundant toward the outskirts, disappearing entirely with the last houses even though the planting of elms extended beyond this point. In other towns similar but less striking observations were made. On the basis of these observations there seems to be little doubt that in the eastern United States *T. pagorum* is almost completely restricted to an urban environment.

Mention has already been made of the preference of *T. pagorum* for elms, a fact which may explain partially, at least, its erratic distribution in certain regions (e. g., the Coastal Plain) as well as its varying abundance from town to town. It is epiphytic on the bark of other tree species, however, in some places forming colonies which equal the development of those on elms, The more important of these are

northern and southern red oak, scarlet oak, sugar maple, red maple, black walnut, pecan, hackberry, and mulberry. Apparently, it is restricted to trees with ridged bark. In the Coastal Plain, where elms are rarely used for street plantings, it develops on live oak, laurel oak, willow oak, and occasionally pecan. In some towns, especially in the Piedmont, it occurs on rocks. Brick or stone walls sometimes support large colonies if it occurs abundantly on nearby trees. In areas where it is scarce, however, it appears to be restricted to trees. This would indicate that it is rupestral only when conditions are exceedingly favorable for its growth.

Observations of the mosses associated with *T. pagorum* reveal a number of bryophytes commonly associated with urban trees. So far as known, however, none of these associated species is restricted to urban habitats. In the Piedmont, its strongest competitor on trees is *Leucodon julaceous*,[28] and frequently to the exclusion of other species, including *T. pagorum*. Other regular associates include *Fabronia ciliaris, Clasmatodon parvulus,* and *Frullania eboracensis,* while those occasionally growing with it are *Orthotrichum ohioense, O. pusillum, Cryphaea glomerata, Leptodon trichomitrion, Anomodon attenuatus, Thelia hirtella, Sematophyllum adnatum, Leskea gracilescens, Drummondia prorepens, Porella platyphylloidea, Cololejeunea Biddlecomiae,* and *Pylaisia intricata.* In the Coastal Plain the most consistent associate is *Ptychomitrium Drummondii* and its superficial resemblance to *T. pagorum* is troublesome to the collector. Additional coastal associates are *Schwetskeopsis denticulata, Microlejeunea ulicina, Leptocolea cardiocarpa, Lejeunea flava,* and *Schlotheimia Sullivantii.* On rocks throughout the East it is found frequently with *Weisia controversa* Hedw., *Barbula unguiculata, Funaria hygrometrica, F. flavicans, Entodon seductrix, Ptychomitrium incurvum, Grimmia apocarpa, Hedwigia ciliata, Amblystegium varium,* and *Tortula muralis.* In Knoxville, Tennessee, Professor Sharp pointed out trees on which *Tortula propagulosa* (endemic there) and the rare *Brothera Leana* grew with *T. pagorum.*

A complete list of citations of the collections of *T. pagorum* which have been made to date follows. Unless otherwise indicated, specimens were collected by the author and have been deposited in the herbarium of Duke University.

[28] Nomenclature throughout is according to Grout (The Bryologist 43: 117–132. 1940).

MARYLAND: Washington Co., Pleasantville Road, near Harper's Ferry, *Daisy Levy*, July, 1919 (S. M. S. Herb.).

WEST VIRGINIA: Jefferson Co., Harper's Ferry, *A. T. Beals 2140* (S. M. S. Herb.).

OHIO: Adams Co., West Union, *Bartley* and *Pontius 2297;* Morgan Co., McConnelsville, *L. E. A. 6879;* Pickaway Co., Jackson Township, *Bartley* and *Pontius 2719,* Circleville, *Bartley* and *Pontius 2153* (S. M. S. Herb.); Ross Co., Kingston, *Bartley* and *Pontius 892* (S. M. S. Herb.).

INDIANA: Jefferson Co., Hanover, *Winona H. Welch, July 1927* (Herb. Depauw Univ.).

VIRGINIA: Albemarle Co., Charlottesville, *L. E. A. 6439;* Dinwiddie Co., Petersburg, *L. E. A. 6320;* Greensville Co., Emporia, *L. E. A. 5726;* Halifax Co., South Boston, *L. E. A. 6318;* Henrico Co., Richmond, *L. E. A. 6328;* Henry Co., Martinsville, *L. E. A. 6436;* Isle of Wight Co., Smithfield, *L. E. A. 6403,* Walters, *D. S. Correll 10,578;* Mecklenburg Co., South Hill, *L. E. A. 6316;* Norfolk Co., Portsmouth, *L. E. A. 6400;* Nottoway Co., Blackstone, *L. E. A. 6891;* Pittsylvania Co., Danville, *L. E. A. 5753;* Spottsylvania Co., Fredericksburg, *L. E. A. 6331.*

KENTUCKY: Barren Co., Glasgow, *L. E. A. 6896;* Boyle Co., Danville, *L. E. A. 6420;* Fayette Co., Lexington, *L. E. A. 6898;* Pulaski Co., Somerset, *L. E. A. 6243.*

NORTH CAROLINA MOUNTAINS: Ashe Co., West Jefferson, *Anderson* and *Blomquist 5855;* Buncombe Co., Asheville, *L. E. A. 6590;* McDowell Co., Old Fort, *L. E. A. 6620.*

NORTH CAROLINA PIEDMONT: Alamance Co., Mebane, *L. E. A. 6110;* Alexander Co., Taylorsville, *L. E. A. 6557;* Anson Co., Wadesboro, *L. E. A. 6315;* Cabarrus Co., Concord, *L. E. A. 6329;* Caswell Co., Yanceyville, *L. E. A. 6114;* Catawba Co., Newton, *L. E. A. 6317;* Chatham Co., Pittsboro, *Anderson* and *Oosting 6093;* Cleveland Co., Kings Mountain, *Anderson* and *Oosting 6101;* Davidson Co., Lexington, *L. E. A. 6900;* Davie Co., Mocksville, *L. E. A. 6127;* Durham Co., Durham, *Blomquist 1930;* Forsyth Co., Winston-Salem, *L. E. A. 6125;* Franklin Co., Franklinton, *L. E. A. 6120;* Gaston Co., Gastonia, *Anderson* and *Oosting 6100;* Granville Co., Oxford, *L. E. A. 6116;* Guilford Co., Gibsonville, *L. E. A. 6111;* Iredell Co., Statesville, *L. E. A. 6126;* Lee Co., Sanford, *Anderson* and *Oosting 6093A;* Lincoln Co., Lincolnton, *L. E. A. 6318;* Mecklenburg Co., Charlotte, *L. E. A. 6096;* Montgomery Co., Troy, *Anderson* and *Oosting 6095;* Moore Co., Carthage, *L. E. A. 6094;* Orange Co., Hillsboro, *L. E. A. 6106;* Person Co., Roxboro, *L. E. A. 6115;* Randolph Co., Asheboro, *L. E. A. 6899;* Rockingham Co., Reidsville, *L. E. A. 6112;* Rowan Co., Salisbury, *L. E. A. 6902;* Rutherford Co., Rutherfordton, *L. E. A. 6419;* Stokes Co., Danbury, *L. E. A. 6247;* Surry Co., Pilot Mountain, *Ruby Williams 1940;* Vance Co., Henderson, *L. E. A. 6117;* Wake Co., Raleigh, *Blomquist 1930;* Warren Co., Warrenton, *L. E. A. 5653.*

NORTH CAROLINA COASTAL PLAIN: Beaufort Co., Washington, *L. E. A. 6670A;* Brunswick Co., Southport, *Anderson* and *Evans 6176;* Craven Co., New Bern, *L. E. A. 6692A;* Dare Co., Manteo, *Anderson* and *Grout 6519;* Greene Co., Snow Hill, *L. E. A. 6124;* Harnett Co., Dunn, *Anderson* and *Evans 6155;* Johnston Co., Clayton, *L. E. A. 6121;* Richmond Co., Hoffman, *L. E. A. 6208;* Robeson Co., Lumberton, *L. E. A. 6836;* Sampson Co., Clinton, *Anderson* and *Evans 6158;* Wayne Co., Goldsboro, *L. E. A. 6122.*

TENNESSEE: Carroll Co., Huntingdon, *L. E. A. 6260;* Claiborne Co., Tazewell, *L. E. A. 6343A;* Davidson Co., Nashville, *L. E. A. 6350;* Dickson Co., Dickson, *L. E. A. 6253;* Dyer Co., Dyersburg, *L. E. A. 6894;* Giles Co., Pulaski, *L. E. A. 6389;* Greene Co., Greenville, *L. E. A. 6129;* Hamblen Co., Morristown, *L. E. A. 6131;* Hardeman Co., Boliver, *L. E. A. 6380;* Humphreys Co., Waverly, *L. E. A. 6257;* Jefferson Co., Jefferson City, *L. E. A. 6132;* Knox Co., Knoxville, *Sharp* and *Welch* 2654 (*Verdoorn, Musci Selecti et Critici 98*), *L. E. A. 6249;* Lincoln Co., Fayetteville, *L. E. A. 6392;* Lawrence Co., Lawrenceburg, *L. E. A. 6387;* Madison Co., Jackson, *L. E. A. 6262;*

Shelby Co., Memphis, *L. E. A. 6265;* Washington Co., Jonesboro, *L. E. A. 6128;* Wayne Co., Waynesboro, *L. E. A. 6386.*

SOUTH CAROLINA: Abbeville Co., Abbeville, *L. E. A. 6288;* Aiken Co., Aiken, *L. E. A. 6881;* Anderson Co., Anderson, *L. E. A. 6284;* Charleston Co., Charleston, *L. E. A. 6196;* Chesterfield Co., Cheraw, *L. E. A. 6276;* Chester Co., Chester, *L. E. A. 6276;* Darlington Co., Society Hill, *D. S.* and *H. B. Correll 8705;* Florence Co., Florence, *D. S.* and *H. B. Correll 8710;* Georgetown Co., Georgetown, *L. E. A. 6192;* Greenville Co., Greenville, *L. E. A. 6281;* Greenwood Co., Greenwood, *L. E. A. 6287;* Horry Co., Conway, *L. E. A. 6190;* Kershaw Co., Camden, *L. E. A. 6884;* Laurens Co., Clinton, *L. E. A. 6286;* Lexington Co., Leesville, *L. E. A. 6882;* Marlboro Co., Bennettsville, *D. S.* and *H. B. Correll 8704;* Oconee Co., Seneca, *L. E. A. 6340;* Richland Co., Columbia, *L. E. A. 6283;* Spartenburg Co., Spartenburg, *L. E. A. 6280;* Union Co., Union, *L. E. A. 6277;* Williamsburg Co., Kingstree, *D. S.* and *H. B. Correll 8720;* York Co., Rock Hill, *L. E. A. 6279.*

GEORGIA: Appling Co., Baxley, *L. E. A. 6863;* Bibb Co., Macon, *L. E. A. 6346;* Carroll Co., Villa Rica, *L. E. A. 6483;* Chatham Co., Savannah, *L. E. A. 6197;* Clarke Co., Athens, *R. McVaugh* and *J. H. Pyron, 1933;* Cobb Co., Marietta, *L. E. A. 6353;* DeKalb Co., Decatur, *L. E. A. 6484;* Emanual Co., Swainsboro, *L. E. A. 6861A;* Floyd Co., Rome, *L. E. A. 6452;* Franklin Co., Royston, *L. E. A. 6842;* Fulton Co., Atlanta, *L. E. A. 6880;* Gwinnett Co., Lawrenceville, *L. E. A. 6355;* Hall Co., Gainesville, *L. E. A. 6356;* Hart Co., Hartwell, *L. E. A.* 6285; Habersham Co., Cornelia, *L. E. A. 6357;* Jefferson Co., Wrens, *L. E. A. 6861;* Liberty Co., Midway, *L. E. A. 6198;* McDuffie Co., Thomson, *L. E. A. 6435;* Macon Co., Montezuma, *L. E. A. 6347;* Morgan Co., Madison, *L. E. A. 6344;* Oglethorpe Co., Lexington, *L. E. A. 6432;* Putnam Co., Eatonton, *L. E. A. 6345;* Richmond Co., Augusta, *J. K. Small 30;* Stevens Co., Toccoa, *L. E. A. 6358;* Sumpter Co., Americus, *L. E. A. 6348;* Toombs Co., Lyons, *L. E. A. 6862;* Wilkes Co., Washington, *L. E. A. 6433.*

ALABAMA: Calhoun Co., Anniston, *L. E. A. 6480;* Clair Co., Pell City, *L. E. A. 6477;* Cleburne Co., Heflin, *L. E. A. 6481;* Jefferson Co., Birmingham, *L. E. A. 6473;* Marion Co., Hamilton, *L. E. A. 6469;* Tallageda Co., Munford, *L. E. A. 6478.*

MISSISSIPPI: Grenada Co., Grenada, *L. E. A. 6271;* Lafayette Co., Oxford, *L. E. A. 6270;* Lee Co., Tupelo, *L. E. A. 6272;* Lowndes Co., Columbus, *L. E. A. 6325;* Panola Co., Batesville, *L. E. A. 6267.*

LOUISIANA: East Baton Rouge Parish, Baton Rouge, *L. E. A. 5762;* Natchitoches Parish, Natchitoches, *L. E. A. 5778A.*

OKLAHOMA: Comanche Co., Wichita Mountains, *A. J. Sharp, 1929;* (Herb. Univ. of Okla.); Greer Co., Granite, *A. J. Sharp, 1929* (Herb. Univ. of Okla.).

TEXAS: Brewster Co., Alpine, *C. R. Orcutt, 1926* (Herb. E. B. Bartram); Jeff Davis Co., Fort Davis, *C. R. Orcutt, 1926* (Herb. E. B. Bartram); McLennan Co., Waco, *G. N. Jones, 1930;* Hopkins Co., Sulphur Springs, *A. J. Sharp 423.*

ARIZONA: Pima Co., Catalina foothills, *E. B. Bartram, 1941;* Santa Cruz Co., Patagonia Mountains, *E. B. Bartram, 1923* (*Holzinger, Exsiccati, Musci Acrocarpi Boreali Americana 500*), Flux Canyon, *E. B. Bartram 1278.*

CALIFORNIA: Contra Costa Co., Berkeley, *Ruth Thornburg, 1916* (Holzinger, *Exsiccati, Musci Acrocarpi Boreali Americana* 360).

The data and observations presented here, then, indicate that *Tortula pagorum* is distributed without interruption from Maryland and West Virginia to the Mississippi River between 30° and 40° north latitude. It extends west through Texas, Oklahoma, and Arizona to California. Its maximum development is reached in the Piedmont Plateau, becoming less abundant north and south of this physiographic

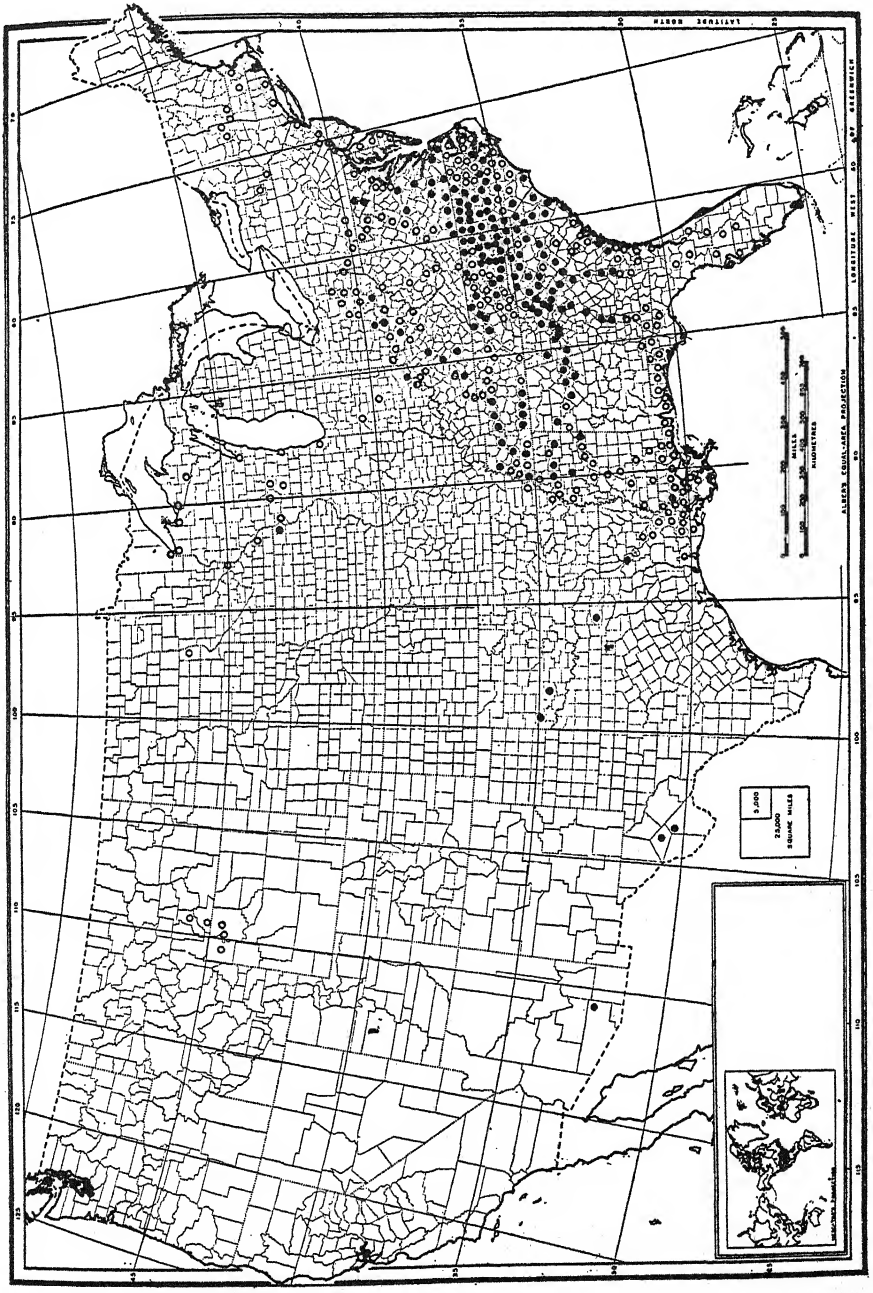
region. It is not disjunct in the eastern part of its range as has previously been supposed. Furthermore, in eastern United States, it is almost strictly limited to habitats created by human activities, whereas in the southwest it shows no relation whatsoever to habitation.

It must be concluded, then, that *T. pagorum* probably appeared in eastern United States after settlement by man and the consequent establishment of an urban environment. It is not likely that it ever formed a part of the so-called "native" vegetation of this region. Many species survived the Cretaceous era in the Appalachians, but evidently *T. pagorum* was not one of these, for it is almost entirely absent there now. Only three scattered stations are known in the mountains and the colonies of each are ill developed and within the confines of towns. It seems best, therefore, to regard *T. pagorum* as adventive certainly in the region east of the Mississippi River and probably in an undetermined area between the Mississippi and Texas, Oklahoma, and Arizona. The lone station on the Pacific coast likewise strongly suggests an introduction.

On the other hand, it seems logical to conclude that *T. pagorum* is entirely native to the southwestern United States (and possibly Mexico, although no collections are known from there). Here it is absolutely independent of habitation and exhibits none of the weedy and erratic aspects of its eastern range. As Mr. Bartram points out (*in litt.*), "in Arizona there are practically no mosses around or near human habitations so that there is practically no question that they are all absolutely native." That this region is the home of *T. pagorum* is strengthened by the fact that the southwest appears to be the center of distribution of its close relatives, *T. laevipila, T. Bartramii, T. caroliniana,* and probably *T. papillosa.* The ranges of all these species overlap in the general region of Arizona, New Mexico and Mexico. The only close relative which does not occur in this area is the rare and endemic *T. propagulosa,* which is known only in Knoxville, Tennessee. Eventually, it too may be discovered in the south-

EXPLANATION OF MAP

Map, showing the distribution of *Tortula pagorum* (Milde) DeNot., in North America. Solid dots represent places from which it has actually been collected and from which specimens are known; circles represent places where one or more searches were conducted for *T. pagorum,* but where it could not be found. Prepared from the base map of Hall's Outline Maps and Graphs—810 R United States (With State and County Boundaries), published by John Wiley & Sons, Inc.


LATITUDE NORTH
LONGITUDE WEST OF GREENWICH
ALBERS EQUAL-AREA PROJECTION
MILES
KILOMETRES
3,000
23,000
SQUARE MILES

west. For years the only known station of *T. caroliniana* was the Smoky Mountains, where it was found originally by Andrews. It is now known to occur elsewhere in Tennessee, and in Mexico and Costa Rica. The ranges of its other relatives, according to Steere[29] are as follows: *T. laevipila*, "Pacific Coast from Mexico to Washington, and east to Nevada and perhaps Arizona"; *T. Bartramii*, Santa Rita, Patagonia, and Santa Catalina Mountains of southern Arizona; Mexico, and California. *T. papillosa*," northeastern states, south to Virginia and North Carolina;[30] west to Michigan and Illinois.

A single small collection from California, correctly named, has been seen, but no collections have apparently been made in the intervening territory."[31] The region of the great Southwest is known to have been the survival center during the Cretaceous of a large number of genera that are now widely distributed in the eastern United States, especially in the Piedmont Plateau and the Coastal Plain. With these, allies of *T. pagorum* evidently migrated into the eastern United States under natural conditions following the respective recessions of the Wisconsin glacier and the Atlantic ocean or else they survived in the Appalachians. But *T. pagorum*, less aggressive, persisted only in the region of the aforementioned survival center until the appearance of man and new conditions of habitat were produced.

It is probably unwise even to speculate concerning the length of time *T. pagorum* has been present in the east, but certain historical inferences strengthen the view that it is adventive. Although known in the east since 1895, it seems highly probable that its present abundance was not reached until fairly recent times. It seems quite unlikely, for instance, that a moss as abundant as *T. pagorum* could have been overlooked by such zealous and observing collectors as Ravenel, Curtis, deSchweinitz, James, Lesquereaux, Sullivant, Michaux, Small, Mohr, et al., all of whom worked at some time within the area in which the species is now exceedingly abundant. Within recent times, Dr. P. O. Schallert has collected exhaustively in Winston-

[29] The Bryologist 43: 12–23; 45–56; 76–86; 98–109.

[30] This is an error. To the best of my knowledge it has not been collected in North Carolina, although in the Moss Flora of North America, Steere attributes the North Carolina record to a specimen of mine. He evidently based this error upon my Number 6130, a collection of *T. papillosa* from Greenville, Greene County. Tennessee, as that is the only collection of this species which I ever made. According to Sharp, this is the only station known in Tennessee.

[31] In 1939, McVaugh and Pyron sent me a specimen of *T. pagorum* collected by them in Athens, Clarke County, Georgia, which contained a few scrappy but unmistakable plants of *T. papillosa*. Georgia, therefore, should be added to its range.

Salem, North Carolina, and vicinity over a period of fifteen years and the Reverend Fred Gray, an especially keen and expert observer, has made intensive collections of bryophytes at many points in the state of North Carolina, yet neither of these observers collected *T. pagorum*. Professor H. L. Blomquist, who made the first collections of this moss in North Carolina, and who was certainly aware of its presence, did not observe it in towns other that Durham and Raleigh, in spite of travels throughout the state. Blomquist affirms that he collected bryophytes on the identical trees in Southport, North Carolina, upon which Dr. Alexander W. Evans and the writer found *T. pagorum* ten years later, yet he did not observe it. In view of its present abundance in Southport and since Blomquist was well acquainted with it, one might suppose that *T. pagorum* appeared on these trees within the past ten years. The extent of its spread at other points during this period is unknown. It is true that the confinement of *T. pagorum* to towns may have been a factor in its having been overlooked, as collectors are not especially prone to collect in towns and cities. The collections of Ravenel, Curtis, Small, Schallert, Gray, and Blomquist, however, indicate that they obtained specimens from urban trees. On this basis, then, one might conclude that the spread of *T. pagorum* in the East has been comparatively recent and that it has occurred rapidly, possibly since the 1920's or later. If true, it is only reasonable to suppose that it is still spreading. If so, the detailed observations presented herein will serve as a basis for future observations.

Two possible explanations for this eastward migration suggest themselves. The first and most logical one is that with the advent of man and the inevitable founding of villages, towns, and cities, a combination of environmental factors was established which proved to be far more suitable for the growth of *T. pagorum* than those of its original home. This favorable environment must be the product of factors now prevailing in the region designated as the Piedmont Plateau, combined with certain conditions created by an urban environment, viz., smoke, gases, etc. How these combine and interact to form such favorable growing conditions for the moss is entirely unknown. Physiological studies upon the physical and chemical requirements of the substrate of *T. pagorum* are needed to answer this question.

The above speculation need not assume that any physiological or structural modifications accompanied the eastward migration of *T.*

pagorum. Examples are well known of instances where a plant, when introduced to new combinations of environmental conditions, finds them more favorable than those of its native home. Many of our weeds and naturalized plants are of foreign origin, *e. g.*, Japanese honeysuckle (*Lonicera japonica* Thunb.), wild carrot (*Daucus carota* L.), quackgrass (*Agropyron repens* Beauv.), etc. A large percentage of our weeds, however, are native to this continent, having migrated from their natural ranges when new and favorable combinations of habitat conditions were created by human activities. The common dandelion (*Taraxacum officinale* Weber), which is now so prevalent in lawns, meadows, and pastures throughout North America, is thought by some authorities to be native in northern North America. It now extends almost to the tropics. On the other hand, the common morning glory (*Ipomoea coccinea* L.), native of tropical America, now extends to southern New York and Missouri in fields, gardens and waste places. Both *Panicum arizonicum* Scribn. and Merr. and *Panicum texanum* Buckl., are southwestern grasses which are adventive in the east. One of the sprangletops, *Leptochloa uninervia* (Presl) Hitchc., is native in North America from Mississippi to Colorado and southern California and south to Mexico, but it is adventive from Maine to North Carolina.[32] Muenscher (1935)[33] in fact, lists 196 species of weeds occuring in the northern United States alone that are native to North America. In this respect, therefore, *T. pagorum* is not unique.

The possibility that eastern plants of *T. pagorum* represent a physiological strain of the species seems unlikely. No such differences have been observed and, morphologically, eastern and western plants are indistinguishable. If physiological segregation did occur, evidently identical changes took place in Europe, for, there, *T. pagorum* has the same habitat restrictions as plants in eastern North America. Again, physiological studies are required to settle this point.

Further study of the European distribution of *T. pagorum* possibly might disclose a situation similar to that on this continent. Its distribution in Europe appears to correspond fairly closely climatically with the United States in that it is southerly. Its habitat relationships in Europe, however, are not fully understood. Loeske (*op. cit.*) infers that in certain parts of Europe, *T. pagorum* grows removed from

[32] Hitchcock (1935), Manual of the grasses of the United States.
[33] Weeds. New York.

habitation, but he does not elaborate on this point. European collections are unavailable at present and correspondence with European bryologists is seriously curbed.

The present study emphasizes the need for further investigations of a phase of ecology that heretofore has been almost completely neglected; namely, the effects upon the distribution of native plants of the changes which man has made in the environment. Too much stress in the past has been placed upon the importance of man's activities as an agent in the dissemination of seeds and spores. More importance should be attached to the actual environmental changes man has produced and is constantly producing. Many of these changes have resulted in a complex of habitat conditions which did not exist previously. In the future it will become increasingly necessary for plant geographers to take these newly established factors into account in studies of plant distribution.

SUMMARY

Tortula pagorum (Milde) DeNot., is a small, usually corticolous moss which, prior to the present study, was considered uncommon and disjunct in its distribution. Only 16 scattered stations were known and they extended from West Virginia and Maryland west to the Pacific Coast.

During the past five years specific searches were made for *T. pagorum* over a large part of eastern United States and observations recorded concerning its habitat relationships. Sufficiently thorough collections were made to map its eastern distribution with considerable accuracy.

Results are presented by the use of a map which shows not only its present known distribution but also the places where searches failed to reveal its presence. Thus areas where its absence on the map is due to insufficient collecting can be distinguished from those where it is actually rare or nonexistent.

One hundred forty-six additional localities are reported in the East and complete citations for all known collections are listed.

Tortula pagorum was found to range uninterruptedly from Maryland and West Virginia to the Mississippi River, being most common in the Piedmont Plateau, less abundant north and south, and almost entirely absent in the Appalachian Mountains.

In eastern United States, it is almost completely confined to human

habitation, *i. e.*, epiphytic on shade trees, and rarely rupestral in cities, towns, villages, farms, etc. This contrasts strongly with southwestern conditions, where it is independent of habitation and grows abundantly up to 6000 feet in Texas and Arizona.

From distributional evidence it is concluded that *T. pagorum* is native to the southwestern United States and entirely adventive in the eastern part of the continent.

ACKNOWLEDGMENTS

The writer wishes to express his indebtedness to Professor Henry J. Oosting for his patience and help during many trips that invariably were delayed by frequent and sometimes monotonous stops to hunt for specimens, and for many valuable suggestions. Professors H. L. Blomquist and Aaron J. Sharp contributed much from their knowledge of and experiences with this moss. Finally thanks are due Mr. E. B. Bartram and Drs. D. S. Correll and R. T. Wareham for generously contributing specimens. Many of the author's collections were made possible by trips in pursuit of other researches which were partially financed by the Research Council of Duke University.

DEPARTMENT OF BOTANY,
DUKE UNIVERSITY,
DURHAM, NORTH CAROLINA.

BRYOPHYTES IN THE VICINITY OF WHEATON COLLEGE, NORTON, MASSACHUSETTS

MABEL A. RICE

After publishing a list of bryophytes from the Island of Nantucket (4) I was interested in comparing them with bryophytes on the mainland. The environs of Wheaton College, Norton, Massachusetts is, in type of land surface, somewhat similar to that of Nantucket. The following report of liverworts and mosses collected in the environs of Wheaton College is made for the purpose of comparing its bryophyte flora with that of Nantucket.

Norton, Massachusetts lies between Boston and Providence on a sandy plain diversified in contour only by the results of glacial action. Among low drumlins and eskers are scattered all stages of hydroseres: lakes, bogs, meadows and wooded land. These are also characteristic

of the northern half of Nantucket Island, although with much less wooded land. The open, sandy stretches around Norton provide similar habitat conditions to the open moorland of Nantucket.

This comparison has, in the first place, corroborated the generally accepted conclusion that a wind-swept, oceanic island is not an ideal habitat for bryophytes. The Nantucket list of 20 liverworts and 53 mosses was the result of diligent search through three summers; the Norton list of 17 liverworts and 65 mosses was the result of occasional collecting made in the environs of Wheaton College during a single semester. I think it will take hard work to increase the Nantucket list to 100 while the collection at Norton has been merely started.

Duplicated on the two lists are 12 liverworts, leaving 8 distinctive ones from Nantucket and 5 from Norton. The fact that the Nantucket list of distinctive species is the longer is due, I think, to the fact of the less thorough search made of the Norton swamps. Three of the five distinctive hepatics of Norton: *Ptilidium pulcherrimum* (Web.) Hampe, *Nowellia curvifolia* (Dicks.) Mitt., and *Frullania eboracensis* Gottsche, may be indices of the more luxuriant forest growth on the mainland. The occurrence of *Frullania* raises an unanswered question. I found it a constant symbiont on the bark of white oak in Norton and on no other tree. White oak is one of the dominants in the occasional forest stands on Nantucket, yet I never found *Frullania* there. The island trees are more often tufted with lichens than with mosses, but this fact would hardly seem the answer.

There were 31 duplicates among the mosses, including species of bogs, woods and dry ground, comprehensive enough to support my thesis of the general similarity between the two regions. The 34 distinctive species from Norton are evidence of the richer moss flora on the mainland; the 22 distinctive mosses from Nantucket would perhaps be found by further search on the mainland.

It is interesting to note that five species of *Sphagnum* were found in each region, with only one duplicate: *Sphagnum palustre* L. I think that in both regions the collection of *Sphagnum* has been merely begun. For this genus, both Nantucket and Norton should prove happy hunting grounds.

The Hepaticae in the following list are arranged in accordance with Evans's checklist (2); the mosses in accordance with the checklists of Grout (3) and Andrews (1).

LIST OF BRYOPHYTES FROM THE VICINITY OF WHEATON COLLEGE, NORTON, MASS.

HEPATICAE

Collected by M. A. Rice, and determined by M. Fulford except as otherwise stated.

1. PTILIDIUM PULCHERRIMUM (Web.) Hampe. Wood Road. Feb. 26, 1942.
2. BAZZANIA TRILOBATA (L.) S. F. Gray. Rehoboth Swamp. Feb. 20, 1938. Det. M. A. Rice.
3. CALYPOGEIA NEESIANA (M. & C.) K. Müll. Copper Swamp. May 15, 1942.
4. CALYPOGEIA TRICHOMANIS (L.) Corda. Copper Swamp. May 15, 1942.
5. CEPHALOZIA BICUSPIDATA (L.) Dumort. Copper Swamp. May 15, 1942.
6. CEPHALOZIA CONNIVENS (Dicks.) Lindb. Lady Craigin's Walk. Apr. 12, 1942.
7. NOWELLIA CURVIFOLIA (Dicks.) Mitt. Wood Road. Feb. 26, 1942.
8. ODONTOCHISMA DENUDATUM (Mart.) Dumort. Wood Road. Feb. 26, 1942.
9. ODONTOCHISMA PROSTRATUM (Sw.) Trevis. Rehoboth Swamp. Feb. 20, 1938. Det. M. A. Rice.
10. LOPHOCOLEA HETEROPHYLLA (Schrad.) Dumort. President's Lane. May 18, 1942.
11. SCAPANIA NEMOROSA (L.) Dumort. Copper Swamp. May 15, 1942.
12. FRULLANIA EBORACENSIS Gottsche. On white oak. Wood Road. Feb. 26, 1942. (Reproducing vegetatively.)
13. PELLIA EPIPHYLLA (L.) Corda. Bank of Ditch, The Pines. Apr. 26, 1942.
14. PALLAVICINIA LYELLII (Hook.) S. F. Gray. The Pines. Feb. 15, 1942.
15. MARCHANTIA POLYMORPHA L. Copper Swamp. Apr. 20, 1940. Det. M. A. Rice.
16. RICCIA FLUITANS L. Outlet, Mansfield Reservoir. Apr. 27, 1942.
17. ANTHOCEROS LAEVIS L. Peacock Pond. Sept. 28, 1937. Det. M. A. Rice.

MUSCI

Collected by M. A. Rice, and determined by R. T. Wareham except as otherwise stated.

1. TETRAPHIS PELLUCIDA Hedw. Wood Road. Mar. 8, 1942.
2. ATRICHUM ANGUSTATUM (Brid.) Bry. Eur. Ditch in the Pines. Apr. 26, 1942.

3. ATRICHUM PAPILLOSUM (Jennings) Frye. The Pines. Mar. 26, 1942. Det. O. E. Jennings.

4. ATRICHUM UNDULATUM (Hedw.) Beauv. The Pines. May 10, 1942. Det. M. A. Rice.

5. POGONATUM PENSILVANICUM (Hedw.) Paris. The Pines. Apr. 17, 1942.

6. POLYTRICHUM COMMUNE Hedw. Northwest Passage. Mar. 29, 1942.

7. POLYTRICHUM PILIFERUM Hedw. Sandpit. May 2, 1942.

8. CERATODON PURPUREUS (Hedw.) Brid. Apr. 13, 1942.

9. CERATODON PURPUREUS f. ARISTATUS (Aust.) E. G. Britton. Mansfield Res. Rd. Apr. 27, 1942.

10. PLEURIDIUM ACUMINATUM Lindb. East Meadow. Apr. 26, 1942.

11. DICRANELLA HETEROMALLA (Hedw.) Schimp. The Pines. Apr. 20, 1942. Det. M. A. Rice.

12. DICRANUM FLAGELLARE Hedw. The Pines. Apr. 17, 1942.

13. DICRANUM FULVUM Hook. Rock in the Pines. Mar. 26, 1942.

14. DICRANUM MONTANUM Hedw. Maple tree, Campus. May 4, 1942.

15. DICRANUM SCOPARIUM (L.) Hedw. Wood Road. Feb. 26, 1942.

16. LEUCOBRYUM GLAUCUM (Hedw.) Schimp. Northwest Passage. Mar. 26, 1942.

17. BUXBAUMIA APHYLLA Hedw. Cathedral Pines. May 15, 1937. Det. M. A. Rice.

18. DIPHYSCIUM FOLIOSUM (Hedw.) Mohr. Ditch in the Pines. Apr. 26, 1942.

19. TORTULA PAPILLOSA Wils. Elm tree, Main Street. May 14, 1942.

20. HEDWIGIA CILIATA Hedw. Rock in the Pines. Mar. 26, 1942.

21. FUNARIA HYGROMETRICA (L.) Hedw. Hockey Field. Apr. 14, 1942.

22. PHYSCOMITRIUM TURBINATUM (Mx.) Brid. The Pines. Apr. 10, 1942.

23. ORTHOTRICHUM PUMILUM Dicks. Elm tree, Talbot Mills. May 19, 1942.

24. ULOTA AMERICANA (Beauv.) Limpr. The Pines. Mar. 26, 1942.

25. AULOCOMNIUM PALUSTRE (Web. & Mohr.) Schwaegr. The Pines. Mar. 23, 1942.

26. PHILONOTIS FONTANA (Hedw.) Brid. Mansfield Reservoir Field. Apr. 27, 1942. Det. M. A. Rice.

27. BRYUM ARGENTEUM (L.) Hedw. Campus path. May 3, 1942.

28. BRYUM CAPILLARE (L.) Hedw. Foxboro, May 27, 1942.

29. POHLIA ANNOTINA var. DECIPIENS Loeske. Campus near gymnasium. Apr. 15, 1942.

30. POHLIA NUTANS (Schreb.) Lindb. The Pines. Apr. 22, 1942.

31. POHLIA WAHLENBERGII (Web. & Mohr.) Andrews. Bank of Peacock Pond. May 19, 1942.

32. MNIUM AFFINE Bland. The Pines. Apr. 12, 1942.

33. MNIUM CUSPIDATUM L. The Pines. Apr. 22, 1942.

34. MNIUM HORNUM L. The Pines. Apr. 13, 1942.

35. MNIUM PUNCTATUM Hedw. Spring, Lady Craigin's Walk. May 19, 1942.

36. AMBLYSTEGIUM JURATZKANUM Schimp. Lady Craigin's Walk. May 25, 1942.

37. BRACHYTHECIUM FLAGELLARE (Hedw.) Jennings. Lady Craigin's Walk. May 19, 1942.

38. BRYHNIA NOVAE-ANGLIAE (Sull. & Lesq.) Grout. Cowslip Swamp, The Pines. Apr. 28, 1942.

39. CALLIERGON CORDIFOLIUM (Hedw.) Kindb. Cowslip Swamp. Apr. 28, 1942.

40. CIRRIPHYLLUM BOSCII (Schwaegr.) Grout. Sand Pit Woods. May 14, 1942.

41. CLIMACIUM KINDBERGII (Ren. & Card.) Grout. Mansfield Reservoir Field. Apr. 27, 1942.

42. DREPANOCLADUS ADUNCUS (Hedw.) Warnst. Mansfield Reservoir. Apr. 27, 1942.

43. DREPANOCLADUS ADUNCUS var. KNEIFFII (Warnst.) Monkem. Mansfield Reservoir. Apr. 27, 1942. Det. F. E. Wynne.

44. ENTODON SEDUCTRIX (Hedw.) C. Müll. Mansfield Res. Road. Apr. 27, 1942.

45. EURHYNCHIUM SERRULATUM (Hedw.) Kindb. The Pines. Mar. 26, 1942.

46. HETEROPHYLLUM HALDANIANUM (Grev.) Kindb. Wood Road. Feb. 26, 1942.

47. HYPNUM CUPRESSIFORME Hedw. Lady Craigin's Walk. May 19, 1942. Det. A. J. Grout.

48. HYPNUM IMPONENS Hedw. The Pines. Mar. 26, 1942.

49. HYPNUM REPTILE Mx. Lady Craigin's Walk. May 19, 1942.

50. HYPNUM REPTILE Mx. Slender form. The Pines. Apr. 10, 1942.

51. LEPTODICTYUM RIPARIUM (Hedw.) Warnst. May 15, 1942.

52. PLAGIOTHECIUM DENTICATULUM (L. Hedw.) Bry. Eur. Copper Swamp. May 15, 1942.

53. PLAGIOTHECIUM STRIATELLUM (Brid.) Lind. The Pines. May 8, 1942.

54. PLATYGYRIUM REPENS (Brid.). Bry. Eur. White oak, Wood Rd. Feb. 26, 1942.

55. ANOMODON ATTENUATUS (Hedw.) Hüben. (depauperate). Lady Craigin's Walk. May 19, 1942.

56. ANOMODON ROSTRATUS (Hedw.) Schimp. The Pines. May 8, 1942.

57. HELODIUM PALUDOSUM (Sull.) Aust. May 15, 1942. Copper Swamp. May 15, 1942.

58. THELIA HIRTELLA (Hedw.) Sull. The Pines. Mar. 26, 1942.

59. THUIDIUM DELICATULUM (Hedw.) Mitt. The Pines. Apr. 13, 1942.

60. FONTINALIS NOVAE-ANGLIAE Sull. Arboretum Brook. Mar. 28, 1942. Det. W. Welch.

61. SPHAGNUM CAPILLACEUM (Weiss.) Schrank. Swamp, Attleboro Rd. Mar. 29, 1942. Det. I. Schnooberger.

62. SPHAGNUM FIMBRIATUM Wils. Copper Swamp. May 15, 1942. Det. I. Schnooberger.

63. SPHAGNUM PALUSTRE L. The Pines. Apr. 12, 1942. Det. I. Schnooberger.

64. SPHAGNUM SQUARROSUM Crome. The Pines. Apr. 17, 1942. Det. I. Schnooberger.

65. SPHAGNUM SUBSECUNDUM Nees. Attleboro Road Swamp. Mar. 29, 1942. Det. I. Schnooberger.

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THE BRYOPHYTE FLORA OF THE EAST COAST OF HUDSON BAY*

FRANCES E. WYNNE AND WILLIAM C. STEERE

Until very recently, the bryophyte flora of Hudson Bay has remained almost totally unknown. The hardships of travel and the rigorous conditions under which the collector finds himself have apparently discouraged bryological investigations in the past. The scarcity of Hudson Bay bryophytes in large herbaria is rather surprising in view of the large collections which have been made much farther north in the Arctic Islands, north of Hudson Bay, and the extensive literature upon them (cf. Bryhn, 1906–1907, Steere, 1939, 1941, 1943). However, the large and critical collections of mosses and liverworts made in the past few years by Dutilly, Duman, and others from Churchill northward along the West Coast of Hudson Bay have shed much light on the problems of the distribution of species there (Steere, 1941). It is already possible, on the basis of the material cited here, to demonstrate that the East Coast has a distinctly different bryological flora than the West Coast, and that in the case of overlapping species, the relative abundance may be very different on different sides of Hudson Bay.

So far as we know, there are no previous reports devoted to collections of bryophytes from the East Coast of Hudson Bay, and the following list therefore contains many important extensions of range. The material reported upon here was collected independently by several individuals, at considerable personal risk and discomfort in a region long notorious for its hazards of travel. The collectors are

* Paper from the Department of Botany, the Herbarium, and the Biological Station of the University of Michigan.

Dr. Margaret T. Doutt, of the Pennsylvania College for Women, in Pittsburgh (in 1935); her husband, J. K. Doutt, of the Carnegie Museum, in Pittsburgh (in 1938), and jointly, Dr. Ernst Abbe and Dr. John Marr of the University of Minnesota (in 1939). Dr. Abbe has also transmitted some specimens collected by Margaret E. Oldenburg, apparently on the Canadian Arctic Patrol of 1939, which fall within the limits of this paper and are therefore included.

A list of the stations at which specimens were collected follows:

ONTARIO:

James Bay

Hayes island, Moose River, June 22–July 5, 1939, *M. T. Doutt 2042–2183.*

South Twin Island, July 22–28, 1935, *M. T. Doutt. 2291–2858.*

QUEBEC:

Fort George, August 31, 1935, *M. T. Doutt 2759.*

Seal River, Cape Jones, Lat. 54° 30′ N., Long. 80° W., September 3, 1939, *J. Marr 457–469.*

Great Whale River, August 9–10, 1935, *M. T. Doutt 2552–2621;* Lat. 55° 15′–55° 30′ N., Long. 77° 30′–78° W., August 16–24, 1939, *J. Marr 400–419.*

Manitounuck Sound

Bill of Portland Island, Manitounuk Islands, August 16, 1935, *M. T. Doutt 2623–2672.*

Lat. 55° 30′–55° 45′ N., Long. 77°–77° 30′ W., August 14, 1939, *J. Marr 395–429.*

Richmond Gulf, Lat. 56°–56° 30′ N., Long. 76°–77° W.

Cairn Island; Mainland south of Cairn Island; Beach Creek, Wiachewan Bay, June 29–July 28, 1939, *J. Marr 300–373.*

Fishing Lake Creek, August 1–5, 1939, *J. Marr 379–393.*

Port Harrison, Lat. 58° 30′ N., Long. 78° 30′ W., August 2–3, 1939, *M. E. Oldenburg 239–254.*

Cape Smith, Lat. 61° N., Long. 77° W., August 1, 1939, *M. E. Oldenburg 217–223.*

Wolstenholme, Lat. 62° 40′ N., Long. 77° 15′ W., July 28, 1939, *M. E. Oldenburg 187.*

Sugluk, Lat. 62° 15′ N., Long. 75° 40′ W., July 26, 1939, *M. E. Oldenburg 157.*

Wakeham Bay, Lat. 61° 30′ N., Long. 72° W., July 24, 1939, *M. E. Oldenburg 137–138.*

NORTHWEST TERRITORIES:

Belcher Islands

Tukarak Island, June 3–August 12, 1938, *J. K. Doutt 15–366.*

Goose Island, July 30, 1938, *J. K. Doutt 230–233.*

Lat. 56°–57° N., Long. 79°–80° W., August 25–31, 1939, *J. Marr 420–456.*

Southampton Island, Lat. 64° 15′ N., Long. 82° 45′ W., July 30, 1939, *M. E. Oldenburg 192–193.*

In the list of species the nomenclature and arrangement follow Brotherus in the second edition of Engler & Prantl's "Die Natürlichen Pflanzenfamilien" for the Musci and Evans' "List of Hepaticae Found in the United States, Canada, and Arctic America" for the Hepaticae.

The authors wish to express appreciation to Dr. Winona H. Welch for the identification of the specimens of *Fontinalis*. The Sphagnaceae, which are not included here, will be reported upon separately by Miss Irma Schnooberger.

HEPATICAE

PTILIDIACEAE

ANTHELIA JULACEA (L.) Dumort. QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M468d.*

PTILIDIUM CILIARE (L.) Nees. ONTARIO: South Twin Island, James Bay, July 28, 1935, *M. T. Doutt 2456.* QUEBEC: Great Whale River, Aug. 9, 1935, *M. T. Doutt 2552;* Aug. 17, 1939, *J. Marr M404b;* Manitounuck Sound, Aug. 14, 1939, *J. Marr M396g;* Cairn Island, Richmond Gulf, June 30, 1939, *J. Marr M313b;* July 2, 1939, *J. Marr M319b;* Cape Smith, Aug. 1, 1939, *M. E. Oldenburg* 219B–c. NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M429j.*

BLEPHAROSTOMA TRICHOPHYLLUM (L.) Dumort. ONTARIO: South Twin Island, James Bay, July 25, 1939, *M. T. Doutt 2400b.* QUEBEC: Cairn Island, Richmond Gulf, July 8, 1939, *J. Marr M346f.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, Aug. 1, 1938, *J. K. Doutt 295c;* Aug. 12, 1938, *J. K. Doutt 358c;* July 30, 1938, *J. K. Doutt 238b;* Belcher Islands, Aug. 26, 1939, *J. Marr M428b, M436i, M430d;* Aug. 29, 1939, *J. Marr M439e;* Aug. 30, 1939, *J. Marr M444h.*

LEPIDOZIACEAE

LEPIDOZIA REPTANS (L.) Dumort. ONTARIO: Hayes Island, Moose River, James Bay, July 5, 1935, *M. T. Doutt 2182b.* QUEBEC: Manitounuck Sound, Aug. 14, 1939, *J. Marr M395a.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M436h.*

CEPHALOZIACEAE

ODONTOSCHISMA MACOUNII (Aust.) Underw. NORTHWEST TERRITORIES: Belcher Islands, Aug. 20, 1939, *J. Marr M430e, M436g.*

HARPANTHACEAE

Lophocolea minor Nees. QUEBEC: Manitounuck Sound, Aug. 14, 1939, *J. Marr M395d.*

MYLIA ANOMALA (Hook.) S. F. Gray. QUEBEC: Great Whale River, Aug. 17, 1939, *J. Marr M403a, M404d.*

JUNGERMANNIACEAE

LOPHOZIA ALPESTRIS (Schleich.) Evans. ONTARIO: South Twin Island, James Bay, July 22, 1935, *M. T. Doutt 2291b.* QUEBEC: Great Whale River, Aug. 10, 1935, *M. T. Doutt 2597b;* Aug. 17, 1939, *J. Marr M401c.*

LOPHOZIA VENTRICOSA (Dicks.) Dumort. ONTARIO: Moose River, James Bay, June 28, 1935, *M. T. Doutt 2108a.*

LOPHOZIA WENZELII (Nees.) Steph. NORTHWEST TERRITORIES: Belcher Islands, Aug. 29, 1939, *J. Marr M439f).*

LEIOCOLEA OBTUSA (Lindb.) Buch. QUEBEC: Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M306e.*

LEIOCOLEA HETEROCOLPA (Thed.) Buch. QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M457d;* Cairn Island, Richmond Gulf, July 8, 1939, *J. Marr M346e.*

SPHENOLOBUS MINUTUS (Crantz) Steph. QUEBEC: Great Whale River, Aug. 17, 1939, *J. Marr M404c, M406b;* Mainland south of Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M322d, M325f;* Port Harrison, Aug. 2, 1939, *M. E. Oldenburg 239A–b;* Aug. 3, 1939, *M. E. Oldenburg 254A–c;* Cape Smith, Aug. 1, 1939, *M. E. Oldenburg 222A–f.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 28, 1938, *J. K. Doutt 198b.*

GYMNOCOLEA INFLATA (Huds.) Dumort. QUEBEC: Cairn Island, Richmond Gulf, June 30, 1939, *J. Marr M312b.*

TRITOMARIA QUINQUEDENTATA (Huds.) Buch [*Lophozia quinquedentata* (Huds.) Cogn.] QUEBEC: Great Whale River, Aug. 10, 1935, *M. T. Doutt 2597;* Aug. 17, 1939, *J. Marr M402b;* Mainland south of Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M322c, M325e, M335b;* July 6, 1939, *J. Marr M352c.*

ORTHOCAULIS KUNZEANA (Hüben.) Evans. QUEBEC: Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M336d.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 30, 1938, *J. K. Doutt 240c.*

SACCOBASIS POLITUS (Nees.) Buch. NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, Aug. 1, 1938, *J. K. Doutt 295e.*

BARBILOPHOZIA BARBATA (Schmid.) Loeske. ONTARIO: Hayes Island, Moose River, James Bay, July 3, 1935, *M. T. Doutt 2166.* QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M459c, M464c, M467b;* Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M311c;* Cape Smith, Aug. 1, 1939, *M. E. Oldenburg 219B–d.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M429i.*

BARBILOPHOZIA LYCOPODIOIDES (Wallr.) Loeske. ONTARIO: South Twin Island, James Bay, July 22, 1935, *M. T. Doutt 2291a.* QUEBEC: Seal River, Cape Jones, July 3, 1939, *J. Marr M466b.*

PLAGIOCHILACEAE

PLAGIOCHILA ASPLENIOIDES (L.) Dumort. QUEBEC: Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M382d.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M427k, M430g.*

SCAPANIACEAE

DIPLOPHYLLUM ALBICANS (L.) Dumort. QUEBEC: Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M380b.*

DIPLOPHYLLUM APICULATUM Evans. QUEBEC: Mainland south of Cairn Island, Richmond Gulf, July 5, 1939, *J. Marr M340b.*

DIPLOPHYLLUM TAXIFOLIUM (Wahlenb.) Dumort. QUEBEC: Fishing Lake Creek, Richmond Gulf, Aug. 3, 1939, *J. Marr M390f.*

SCAPANIA CUSPIDULIGERA (Nees) K. Müll. QUEBEC: Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M306g.*

SCAPANIA IRRIGUA (Nees) Dumort. QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M468c.*

SCAPANIA UNDULATA (L.) Dumort. NORTHWEST TERRITORIES: Belcher Islands, Aug. 29, 1939, *J. Marr M422g.*

PELLIACEAE

PELLIA EPIPHYLLA (L.) Corda. QUEBEC: Great Whale River, Aug 10, 1935, *M. T. Doutt 2594c.*

RICCARDIACEAE

RICCARDIA PINGUIS (L.) S. F. Gray. QUEBEC: Bill of Portland Island, Manitounuk Sound, Aug. 16, 1935, *M. T. Doutt 2662d.*

MARCHANTIACEAE

MARCHANTIA POLYMORPHA L. ONTARIO: Moose River, James Bay, June 24, 1935, *M. T. Doutt 2103;* South Twin Island, James Bay, July 23, 1935, *M. T. Doutt 2538a.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 6, 1938, *J. K. Doutt 101a.*

PREISSIA QUADRATA (Scop.) Nees. ONTARIO: South Twin Island, James Bay, July 23, 1935, *M. T. Doutt 3248c.*

MUSCI

ANDREAEACEAE

ANDREA RUPESTRIS Hedw. QUEBEC: Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M454.*

TETRAPHIDACEAE

TETRAPHIS PELLUCIDA Hedw. ONTARIO: Moose River, James Bay, June 24, 1935, *M. T. Doutt 2099b.*

FISSIDENTACEAE

FISSIDENS OSMUNDIOIDES Hedw. ONTARIO: South Twin Island, James Bay, July 23, 1935, *M. T. Doutt 2348a.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M430c, M432c, M436j.*

DITRICHACEAE

CERATODON PURPUREUS (Hedw.) Brid. ONTARIO: Hayes Island, Moose River, James Bay, June 28, 1935, *M. T. Doutt 2112c.* QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M457b;* Great Whale River, Aug. 21, 1939, *J. Marr M414c, 415a;* Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M304a, M307a;* July 3, 1939, *J. Marr M329b, M336c, M337, M338a;* Beach Creek, Richmond Gulf, July 15, 1939, *J. Marr M364b;* Cape Smith, Aug. 1, 1939, *M. E. Oldenburg 222A–b.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, June 3, 1938, *J. K. Doutt 15c, 180;* July 20, 1938, *J. K. Doutt 188a;* July 28, 1938, *J. K. Doutt 200a;* July 31, 1938, *J. K. Doutt 277b;* Aug. 1, 1938, *J. K. Doutt 297b, 300;* Aug. 12, 1938, *J. K. Doutt 357b;* Belcher Islands, Aug. 25, 1939, *J. Marr M420b;* Aug. 26, 1939, *J. Marr M429f;* Aug. 29, 1939, *J. Marr M437b, M440, M443;* Aug. 30, 1939, *J. Marr M448a, M449c, M450a.*

DISTICHIUM CAPILLACEUM (Hedw.) Bry. Eur. ONTARIO: South Twin Island, James Bay, July 23, 1935, *M. T. Doutt 2348b.* QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M468a;* Mainland south of Cairn Island,

Richmond Gulf, July 3, 1939, *J. Marr M327a;* Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr* M385b; Beach Creek, Richmond Gulf, July 15, 1939, *J. Marr M360a.* NORTHWEST TERRITORIES: Belcher Islands, *J. K. Doutt x–b;* Aug. 30, 1939, *J. Marr M444a; M447b,* Aug. 26, 1939, *J. Marr M422a, M427d, M428a, M429a, M433d;* Aug. 29, 1939, *J. Marr M439a, M442c, M441a.*

DISTICHIUM HAGENI Ryan. ONTARIO: South Twin Island, James Bay, July 22, 1935, *M. T. Doutt 2313a.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, Aug. 9, 1938, *J. K. Doutt 324.*

DISTICHIUM INCLINATUM (Hedw.) Bry. Eur. NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 30, 1938, *J. K. Doutt 239a.*

DITRICHUM FLEXICAULE (Schwaegr.) Hampe. QUEBEC: Manitounuck Sound, Aug. 14, 1939, *J. Marr M396f;* Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M306d;* Mainland south of Cairn Island, July 6, 1939, *J. Marr M354c;* Cape Smith, Aug. 1, 1939, *M. E. Oldenburg 222A–e.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 20, 1938, *J. K. Doutt 188b;* Aug. 9, 1938, *J. K. Doutt 313e;* Belcher Islands, Aug. 26, 1939, *J. Marr M426c;* Aug. 29, 1939, *J. Marr M442d;* Aug. 30, 1939, *J. Marr M444b.*

SAELANIA GLAUCESCENS (Hedw.) Broth. QUEBEC: Mainland south of Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M324a, M325d;* July 6, 1939, *J. Marr M353, M355a.*

SELIGERIACEAE

BLINDIA ACUTA (Hedw.) Bry. Eur. QUEBEC: Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M382a.*

DICRANACEAE

DICHODONTIUM PELLUCIDUM (Hedw.) Schimp. NORTHWEST TERRITORIES: Belcher Islands, Aug. 29, 1939, *J. Marr M439c.*

DICRANELLA VARIA (Hedw.) Schimp. ONTARIO: Hayes Island, Moose River, James Bay, June 22, 1935, *M. T. Doutt 2045b.*

DICRANOWEISIA CRISPULA (Hedw.) Lindb. QUEBEC: Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M381a.*

ONCOPHORUS POLYCARPUS (Hedw.) Brid. QUEBEC: Cairn Island, Richmond Gulf, June 29, 1939, *J Marr M305;* June 30, 1939, *J. Marr M313a;* July 1, 1939, *J. Marr M317;* July 6, 1939, *J. Marr M355b;* Port Harrison, Aug. 3, 1939, *M. E. Oldenburg 254A–a.*

ONCOPHORUS POLYCARPUS var. STRUMIFERUS (DeNot.) Grout. QUEBEC: Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M333.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 30, 1939, *J. K. Doutt 243;* July 31, 1939, *J. K. Doutt 279.*

ONCHOPHORUS STRUMULOSUS (C. Müll. & Kindb.) E. G. Britton. QUEBEC: Cairn Island, Richmond Gulf, July 1, 1939, *J. Marr M314;* July 8, 1939, *J. Marr M347b.*

ONCOPHORUS TENELLUS (Bry. Eur.) Williams. QUEBEC: Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M387a.*

ONCOPHORUS VIRENS (Hedw.) Brid. QUEBEC: Wiachewan Bay, Richmond Gulf, July 17, 1939, *J. Marr M373a.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 30, 1938, *J. K. Doutt 238a, 240a;* Aug. 10, 1938, *J. K. Doutt 363;* Aug. 12, 1938, *J. K. Doutt 358a.*

ONCOPHORUS WAHLENBERGII Brid. ONTARIO: Moose River, James Bay, June 28, 1935, *M. T. Doutt 2111, 2112a, 2116a.* QUEBEC: Great Whale River, Aug. 16, 1939, *J. Marr M400;* Aug. 17, 1939, *J. Marr M404c, M407b;* Manitounuck Sound, Aug. 14, 1939, *J. Marr M397b;* Bill of Portland Island, Manitounuck Sound, Aug. 16, 1935, *M. T. Doutt 2623;* Mainland south of Cairn Island, Richmond Gulf, July 6, 1939, *J. Marr M351;* Cairn Island; Richmond Gulf, July 3, 1938, *J. Marr M328c.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Island, July 30, 1938, *J. K. Doutt 237;* Belcher Islands, Aug. 26, 1939, *J. Marr M421a.*

DICRANUM BONJEANI DeNot. QUEBEC: Great Whale River, Aug. 17, 1939, *J. Marr M404a.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M433f.*

DICRANUM CONDENSATUM Hedw. ONTARIO: South Twin Island, James Bay, July 22, 1935, *M. T. Doutt 2314,* QUEBEC: Great Whale River, Aug. 10, 1935, *M. T. Doutt 2597a;* Aug. 17, 1939, *J. Marr M408b;* Aug 21, 1939, *J. Marr M414a.* NORTHWEST TERRITORIES: Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M336b.*

DICRANUM ELONGATUM Schleich. ONTARIO: South Twin Island, James Bay, July 23, 1935, *M. T. Doutt 2372b.* QUEBEC: Fort George, Aug. 31, 1935, *M. T. Doutt 2759b;* Great Whale River, Aug. 17, 1939, *J. Marr M406a;* Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M310;* Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M383a;* Port Harrison, Aug. 3, 1939, *M. E. Oldenburg 254A–a.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M421b;* Aug. 30, 1939, *J. Marr M445b.*

DICRANUM GROENLANDICUM Brid. ONTARIO: South Twin Island, James Bay, July 22, 1935, *M. T. Doutt 2342.*

DICRANUM LAEVIDENS Williams. ONTARIO: South Twin Island, James Bay, July 22, 1935, *M. T. Doutt 2329.*

DICRANUM RUGOSUM (Hoffm.) Brid. ONTARIO: Hayes Island, Moose River, James Bay, June 28, 1935, *M. T. Doutt 2108c;* July 5, 1935, *M. T. Doutt 2182a.*

DICRANUM SCOPARIUM Hedw. QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M459b, M464a, M467a;* Great Whale River, Aug. 21, 1939, *J. Marr M410a;* Wiachewan Bay, Richmond Gulf, July 17, 1939, *J. Marr M372b.*

ENCALYPTACEAE

ENCALYPTA ALPINA Smith. NORTHWEST TERRITORIES: Belcher Islands, *J. K. Doutt x–d.*

ENCALYPTA CILIATA Hedw. QUEBEC: Mainland south of Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M331.*

ENCALYPTA RHABDOCARPA Schwaegr. QUEBEC: Manitounuck Sound. Aug. 14, 1939, *J. Marr M397a;* Mainland south of Cairn Island, Richmond Gulf, July 6, 1939, *J. Marr M354b, M356a;* Fishing Lake Creek, Richmond Gulf, Aug. 1, 1938, *J. Marr M386.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M426f, M427b, M456a;* Aug. 29, 1939, *J. Marr M437d, M442b.*

POTTIACEAE

TORTELLA FRAGILIS (Drummond) Limpr. QUEBEC: Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M306c;* Richmond Gulf, July 30, 1939, *J. Marr M378c.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, *J. K. Doutt x–f;* Aug. 9, 1938, *J. K. Doutt 313b;* Belcher Islands, Aug. 26, 1939, *J. Marr M429d, M432d;* Aug. 29, 1939, *J. Marr M441c, M442f.*

TORTELLA TORTUOSA (Hedw.) Limpr. QUEBEC: Fishing Lake Creek, Richmond Gulf, Aug. 3, 1939, *J. Marr M390d;* Mainland south of Cairn Island, Richmond Gulf, July 6, 1939, *J. Marr M356c.*

DIDYMODON RECURVIROSTRIS (Hedw.) Jennings. QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M458b, M460, M466c;* Manotounuck Sound, Aug. 14, 1939, *J. Marr M395f, M427e, M429e.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, Aug. 26, 1939, *J. Marr M435b;* Aug. 29, 1939, *J. Marr M441d.*

TORTULA NORVEGICA (Web. & Mohr.) Wahlenb. NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M427h.*

TORTULA RURALIS (Hedw.) Smith. ONTARIO: South Twin Island, James Bay, July 22, 1935, *M. T. Doutt 2341b.* QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M457c;* Manitounuck Sound, Aug. 14, 1939, *J. Marr M395c, M396b;* Richmond Gulf, July 30, 1939, *J. Marr M378b;* Cape Smith,

Aug. 1, 1939, *M. E. Oldenburg 222A–c.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, Aug. 9, 1938, *J. K. Doutt 313f.*

GRIMMIACEAE

GRIMMIA APOCARPA Hedw. QUEBEC: Cairn Island, Richmond Gulf, July 8, 1939, *J. Marr M346c.*

RHACOMITRIUM CANESCENS Brid. QUEBEC: Great Whale River, Aug. 10, 1935, *M. T. Doutt 2598a;* Aug. 21, 1939, *J. Marr M408, M409b.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 30, 1939, *J. Marr M451a.*

RHACOMITRIUM LANUGINOSUM (Hedw.) Brid. QUEBEC: Great Whale River, Aug. 10, 1935, *M. T. Doutt 2596;* Bill of Portland Island, Manitounuck Sound, Aug. 16, 1935, *M. T. Doutt 2639;* Mainland south of Cairn Island, Richmond Gulf, July 6, 1939, *J. Marr M354d, M356b.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, Aug. 12, 1938, *J. K. Doutt 357c;* Belcher Islands, Aug. 30, 1939, *J. Marr M448b.*

FUNARIACEAE

FUNARIA HYGROMETRICA Hedw. ONTARIO: Hayes Island, Moose River, James Bay, June 22, 1935, *M. T. Doutt 2045a, 2047b.*

SPLACHNACEAE

TETRAPLODON MNIOIDES (Hedw.) Bry. Eur. QUEBEC: Manitounuck Sound, Aug. 14, 1939, *J. Marr M399;* Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M302, M303, M309;* July 1, 1939, *J. Marr M316;* July 3, 1939, *J. Marr M330.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, June 3, 1938, *J. K. Doutt 16;* July 28, 1938, *J. K. Doutt 199, 201;* Aug. 1, 1938, *J. K. Doutt 291, 296, 297a;* Aug. 9, 1938, *J. K. Doutt 313a, 320;* Belcher Islands, Aug. 25, 1939, *J. Marr M420a;* Aug. 30, 1939, *J. Marr M450b.*

TAYLORIA LINGULATA (Dicks.) Lindb. NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M432a.*

HAPLODON WORMSKJOLDII (Hornem.) R. Brown. QUEBEC: Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M328e;* July 8, 1939, *J. Marr M343;* Mainland south of Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M320.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, June 3, 1938, *J. K. Doutt 15d.*

BRYACEAE

POHLIA CRUDA (Hedw) Lindb. ONTARIO: Moose River, James Bay, June 24, 1935, *M. T. Doutt 2099a;* South Twin Island, James Bay, July 22. 1935, *M. T. Doutt 2341c.* QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M469;* Great Whale River, Aug. 17, 1939, *J. Marr M402a;* Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M306a;* Mainland south of Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M322b, M323, M324b, M326, M335a;* July 6, 1939, *J. Marr M352b;* Beach Creek, Richmond Gulf, July 15, 1939, *J. Marr M359, M365.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 6, 1938, *J. K. Doutt 101b;* Belcher Islands, Aug. 26, 1939, *J. Marr M429b;* Aug. 29, 1939, *J. Marr 437a;* Aug. 30, 1939, *J. Marr M444, M447a.*

POHLIA NUTANS (Hedw.) Lindb. ONTARIO: Mouth of Moose River, James Bay, July 1, 1935. *M. T. Doutt 2136;* South Twin Island, James Bay, July 23, 1935, *M. T. Doutt 2409.* QUEBEC: Great Whale River, Aug. 17, 1939, *J. Marr M402c;* Cairn Island, Richmond Gulf, July 8, 1939, *J. Marr M349;* Port Harrison, Aug. 3, 1939, *M. E. Oldenburg 254A–b.*

POHLIA ROTHII (Correns) Broth. QUEBEC: Great Whale River, Richmond Gulf, Aug. 21, 1939, *J. Marr M412.*

POHLIA WAHLENBERGII (Web. & Mohr) Andrews. QUEBEC: Great Whale River, Aug. 10, 1935, *M. T. Doutt 2595.*

LEPTOBRYUM PYRIFORME (Hedw.) Schimp. QUEBEC: Seal River, Cape

Jones, Sept. 3, 1939, *J. Marr M465b.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 29, 1939, *J. Marr M439d.*

BRYUM ARCTICUM (R. Br.) Bry. Eur. QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M458a;* Wiachewan Bay, Richmond Gulf, July 17, 1939, *J. Marr M375;* Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M338;* Cape Smith, Aug. 1, 1939, *M. E Oldenburg 217B.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 29, 1939, *J. Marr M437c, M438.*

BRYUM ARGENTEUM Hedw. QUEBEC: Wiachewan Bay, Richmond Gulf, July 17, 1939, *J. Marr M369c, M455.* NORTHWEST TERRITORIES: Southampton Island, July 30, 1939, *M. E. Oldenburg 192B.*

BRYUM BIMUM Schreb. ONTARIO: Hayes Island, Moose River, James Bay, June 23, 1935, *M. T. Doutt 2069c;* June 28, 1935, *M. T. Doutt 2110a.* QUEBEC: Manitounuck Sound, Aug. 14, 1939, *J. Marr M394;* Cape Smith, Aug. 1, 1939, *M. E. Oldenburg 217C;* Sugluk, July 26, 1939, *M. E. Oldenburg 153A, 157A.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, Aug. 9, 1938, *J. K. Doutt 314, 323;* Goose Island, Belcher Islands, July 30, 1938, *J. K. Doutt 231a.*

BRYUM CAESPITICIUM Hedw. ONTARIO: South Twin Island, James Bay, July 22, 1935, *M. T. Doutt 2341a.* QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M468b;* Wiachewan Bay, Richmond Gulf, July 17, 1939, *J. Marr M369b;* Richmond Gulf, July 30, 1939, *J. Marr M378a.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 31, 1938, *J. K. Doutt 276;* Aug. 12, 1938, *J K. Doutt 355b, 361b.*

BRYUM CUSPIDATUM (Bry. Eur.) Schimp. NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 28, 1938, *J. K. Doutt 200b;* Belcher Islands, Aug. 20, 1939, *J. Marr M451b.*

BRYUM INCLINATUM (Web. & Mohr) Sturm. NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, Aug. 1, 1938, *J. K. Doutt 299;* Aug. 9, 1938, *J. K. Doutt 321;* Aug. 12, 1938, *J. K. Doutt 355b;* Belcher Islands, Aug. 20, 1939, *J. Marr M446.*

BRYUM PALLENS Sw. QUEBEC: Beach Creek, Richmond Gulf, July 15, 1939, *J. Marr M363.*

BRYUM PALLESCENS Schleich. QUEBEC: Cape Jones, Sept. 3, 1939, *J. Marr M461.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, Aug. 1, 1938, *J. K Doutt 300;* Aug. 9, 1938, *J. K. Doutt 316, 322, 325;* Aug. 10, 1938, *J. K. Doutt 348.*

BRYUM PENDULUM (Hornsch.) Schimp. QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M462.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 30, 1938, *J. K. Doutt 242.*

BRYUM PSEUDOTRIQUETRUM (Hedw.) Schwaegr. QUEBEC: Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M307c;* Wiachewan Bay, Richmond Gulf, July 17, 1939, *J. Marr M373b;* Wakeham Bay, July 24, 1939, *M. E. Oldenburg 137.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M426b.*

BRYUM TURBINATUM (Hedw.) Schwaegr. QUEBEC: Cairn Island, Richmond Gulf, June 29, 1939. *J. Marr M300b, M308.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, Aug. 8, 1938, *J. K. Doutt 321.*

BRYUM WRIGHTII Sull. & Lesq. QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M458a.*

MNIACEAE

MNIUM AFFINE Bland. ONTARIO: Hayes Island, Moose River, James Bay, June 22, 1935, *M. T. Doutt 2047a;* June 23, 1935, *M. T. Doutt 2058d, 2071;* July 1, 1935, *M. T. Doutt 2135;* South Twin Island, James Bay, July 28, 1935, *M. T. Doutt 2457b.* QUEBEC: Great Whale River, Aug. 10, 1935, *M. T. Doutt 2594d;* Wakeham Bay, July 24, 1939, *M. E. Oldenburg 138A.* NORTHWEST TERRITORIES: Belcher Island, Aug. 26, 1939, *J. Marr M436d.*

MNIUM HYMENOPHYLLOIDES Hüben. NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M430h, M432g.*

MNIUM ORTHORHYNCHUM Brid. QUEBEC: Fishing Lake Creek, Richmond Gulf, Aug. 3, 1939, *J. Marr M390a;* Mainland south of Cairn Island, Richmond Gulf, July 6, 1939, *J. Marr M354a;* Beach Creek, Richmond Gulf, July 15, 1939, *J. Marr M360b.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 28, 1938, *J. K. Doutt 200c;* Belcher Islands, Aug. 26, 1939, *J. Marr M427a, M429g, M433c, M456d.*

MNIUM PUNCTATUM Hedw. ONTARIO: Hayes Island, Moose River, James Bay, July 5, 1935, *M. T. Doutt 2183;* South Twin Island, James Bay, July 23, 1935, *M. T. Doutt 2375b.* QUEBEC: Great Whale River, Aug. 22, 1939, *J. Marr M416c, M417a;* Richmond Gulf, Aug. 5, 1939, *J. Marr M393e.*

CINCLIDIUM STYGIUM Sw. ONTARIO: South Twin Island, James Bay, July 22, 1935, *M. T. Doutt 2328a;* July 23, 1935, *M. T. Doutt 2358b.* QUEBEC: Manitounuck Sound, Aug. 14, 1939, *J. Marr M398b;* Mainland south of Cairn Island, Richmond Gulf, July 5, 1939, *J. Marr M341.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 28, 1938, *J. K. Doutt 202a;* Aug. 12, 1938, *J. K. Doutt 366b;* Belcher Islands, Aug. 26, 1939, *J. Marr M431b, M433g.*

CINCLIDIUM SUBROTUNDUM Lindb. QUEBEC: Bill of Portland Island, Manitounuck Sound, Aug. 16, 1935, *M. T. Doutt 2662b.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 31, 1938, *J. K. Doutt 280b.*

AULACOMNIACEAE

AULACOMNIUM PALUSTRE (Hedw.) Schwaegr. ONTARIO: Moose River, James Bay, June 24, 1935, *M. T. Doutt 2101.* QUEBEC: Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M311b;* July 3, 1939, *J. Marr M329a;* Cape Smith, Aug. 1, 1939, *M. E. Oldenburg 219A.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M425, M433b;* Aug. 30, 1939, *J. Marr M449a;* Southampton Island, July 30, 1939, *M. E. Oldenburg 192A.*

AULACOMNIUM TURGIDUM (Wahlenb.) Schwaegr. ONTARIO: South Twin Island, James Bay, July 25, 1935, *M. T. Doutt 2400a.* QUEBEC: Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M328a.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 28, 1938, *J. K. Doutt 198c;* Aug. 1, 1938, *J. K. Doutt 297b;* Aug. 12, 1938, *J. K. Doutt 356c.*

MEESIA TRIQUETRA (Hook. & Tayl.) Ångstr. ONTARIO: South Twin Island, James Bay, July 22, 1935, *M. T. Doutt 2328d;* July 27, 1935, *M. T. Doutt 2428.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 31, 1938, *J. K. Doutt 280c.*

MEESIA ULIGINOSA Hedw. QUEBEC: Great Whale River, Aug. 22, 1939, *J. Marr M418b;* Beach Creek, Richmond Gulf, July 12, 1939, *J. Marr M358;* Richmond Gulf, Aug. 5, 1939, *J. Marr M393d.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, *J. K. Doutt x–a;* Aug. 12, 1938, *J. K. Doutt 362b, 364a;* July 31, 1938, *J. K. Doutt 278;* Aug. 1, 1938, *J. K. Doutt 295b;* Goose Island, Belcher Islands, July 30, 1938, *J. K. Doutt 230, 323a, 233a;* Belcher Islands, Aug. 26, 1939, *J. Marr M428c, M430b;* Aug. 30, 1939, *J. Marr M436c, M444d, M449b;* Aug. 31, 1939, *J. Marr M453a.*

PALUDELLA SQUARROSA (Hedw.) Brid. ONTARIO: South Twin Island, James Bay, July 28, 1935, *M. T. Doutt 2457a, 2858a.* QUEBEC: Richmond Gulf, Aug. 5, 1939, *J. Marr M393f.*

CATOSCOPIACEAE

CATOSCOPIUM NIGRITUM (Hedw.) Brid. NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, June 3, 1938, *J. K. Doutt 15a;* July 30, 1938, *J. K. Doutt 236;* Aug. 1, 1938, *J. K. Doutt 295d;* Belcher Islands, Aug. 26, 1939, *J. Marr M424, M426d, M431e, M435a.*

BARTRAMIACEAE

CONOSTOMUM BOREALE Swartz. QUEBEC: Cairn Island, Richmond Gulf, June 30, 1939, *J. Marr M312a;* July 3, 1939, *J. Marr M334;* Mainland south of Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M325c.*

BARTRAMIA ITHYPHYLLA Brid. QUEBEC: Mainland south of Cairn Island, Richmond Gulf, July 2, 1939, *J. Marr M318a;* July 3, 1939, *J. Marr M325a;* Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M380a.*

PHILONOTIS AMERICANA Dismier. QUEBEC: Great Whale River, Aug. 22, 1939, *J. Marr M416b.*

PHILONOTIS CAESPITOSA Wils. QUEBEC: Port Harrison, Aug. 3, 1939, *M. E. Oldenburg 254B.*

PHILONOTIS FONTANA (Hedw.) Brid. ONTARIO: Hayes Island. Moose River, James Bay, June 22, 1935, *M. T. Doutt 2048;* South Twin Island, James Bay, Aug. 1, 1935, *M. T. Doutt 2501.* QUEBEC: Beach Creek, Richmond Gulf, July 15, 1939, *J. Marr M362.*

PHILONOTIS MARCHICA (Willd.) Brid. QUEBEC: Wiachewan Bay, Richmond Gulf, July 17, 1939, *J. Marr M371a.*

PHILONOTIS TOMENTELLA Mol. NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 30, 1938, *J. K. Doutt 241;* Aug. 1, 1938, *J. K. Doutt 292, 293, 294a.*

PLAGIOPUS OEDERI (Brid.) Limpr. QUEBEC: Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M385a.*

TIMMIACEAE

TIMMIA AUSTRIACA Hedw. NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1929, *J. Marr M432f.*

ORTHOTRICHACEAE

ORTHOTRICHUM MICROBLEPHARUM Schimp. QUEBEC: Cairn Island, Richmond Gulf, July 8, 1939, *J. Marr M346a;* Mainland south of Cairn Island, Richmond Gulf, July 5, 1939, *J. Marr M342;* Wiachewan Bay, Richmond Gulf, July 17, 1939, *J. Marr M369a, M370, M376;* Fishing Lake Creek, Richmond Gulf, Aug. 2, 1939, *J. Marr M389.*

ULOTA AMERICANA (Beauv.) Limpr. QUEBEC: Mainland south of Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M321.*

AMPHIDIUM LAPPONICUM (Hedw.) Schimp. QUEBEC: Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M382c.*

FONTINALACEAE

FONTINALIS ANTIPYRETICA Hedw. QUEBEC: Cairn Island, Richmond Gulf July 8, 1939, *J. Marr M344, M348.*

CLIMACIACEAE

CLIMACIUM DENDROIDES Web. & Mohr. ONTARIO: Hayes Island, Moose River, James Bay, June 28, 1935, *M. T. Doutt 2114a;* South Twin Island, James Bay, July 23, 1935, *M. T. Doutt 2374, 2375a.*

HEDWIGIACEAE

HEDWIGIA CILIATA Hedw. NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M456c.*

THELIACEAE

MYURELLA JULACEA (Schwaegr.) Bry. Eur. ONTARIO: South Twin Island, James Bay, July 22, 1935, *M. T. Doutt 2313b.* QUEBEC: Cairn Island, Richmond Gulf, July 8, 1939, *J. Marr M346d;* Mainland south of Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M327b;* Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M387b.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, *J. K. Doutt x–c;* July 28, 1938, *J. K. Doutt 200d;* Belcher Islands, Aug. 26, 1939, *J. Marr M422c, M427b, M429c, M430a, M456b;* Aug. 29, 1939, *J. Marr M439b, M442e;* Aug. 30, 1939, *J. Marr M444.*

MYURELLA TENERRIMA (Brid.) Lindb. [*Myurella apiculata* (Hedw.) Bry. Eur.] NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M428d;* Aug. 29, 1939, *J. Marr M441b;* Aug. 31, 1939, *J. Marr M453c.*

THUIDIACEAE

ABIETINELLA ABIETINA (Brid.) C. Müll. [*Thuidium abietinum* (Hedw.) Bry. Eur.] QUEBEC: Manitounuck Sound, Aug. 14, 1939, *J. Marr M395e;* Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M305;* Fishing Lake Creek, Richmond Gulf, Aug. 4, 1939, *J. Marr M391.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 31, 1938, *J. K. Doutt 277c.*

THUIDIUM DELICATULUM (Hedw.) Mitt. ONTARIO: Hayes Island, Moose River, James Bay, June 22, 1935, *M. T. Doutt 2042a;* June 28, 1935, *M. T. Doutt 2114c.*

HELODIUM BLANDOWII (Web. & Mohr) Warnst. ONTARIO: South Twin Island, James Bay, July 28, 1935, *M. T. Doutt 2457c, 2858.*

AMBLYSTEGIACEAE

AMBLYSTEGIUM SERPENS (Hedw.) Br. & Sch. ONTARIO: Hayes Island, Moose River, James Bay, June 23, 1935, *M. T. Doutt 2070a.*

CAMPYLIUM POLYGAMUM (Bry. Eur.) Bryhn. ONTARIO: Hayes Island, Moose River, James Bay, June 23, 1935, *M. T. Doutt 2069b;* June 22, 1935, *M. T. Doutt 2043.* NORTHWEST TERRITORIES: Goose Island, Belcher Islands, July 30, 1938, *J. K. Doutt 233b;* Belcher Islands, Aug. 30, 1939, *J. Marr M447c.*

CAMPYLIUM RADICALE (Beauv.) Grout. ONTARIO: Hayes Island, Moose River, James Bay, June 23, 1935, *M. T. Doutt 2070c.*

CAMPYLIUM STELLATUM (Hedw.) Lange & C. Jens. NORTHWEST TERRITORIES: Goose Island, Belcher Islands, July 30, 1938, *J. K. Doutt 231, 232b;* Belcher Islands, Aug. 26, 1939, *J. Marr M423a, M426e, M427c, M433e.*

HYGROHYPNUM ALPESTRE (Hedw.) Loeske. NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, Aug. 12, 1938, *J. K. Doutt 355a, 361a.*

HYGROHYPNUM OCHRACEUM (Turn.) Loeske. QUEBEC: Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M382b.*

HYGROHYPNUM PALUSTRE (Hedw.) Loeske. QUEBEC: Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M381b.*

DREPANOCLADUS ADUNCUS var. KNEIFFII (Bry. Eur.) Mönkem. ONTARIO: Moose River, James Bay, July 1, 1935, *M. T. Doutt 2150.* QUEBEC: Wiachewan Bay, Richmond Gulf, July 17, 1939, *J. Marr M374.*

DREPANOCLADUS EXANNULATUS (Bry. Eur.) Warnst. QUEBEC: Great Whale River, Aug. 10, 1935, *M. T. Doutt 2601;* Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M339;* July 8, 1939, *J. Marr M350.*

DREPANOCLADUS EXANNULATUS var. ROTAE (DeNot.) Grout. QUEBEC: Fishing Lake Creek, Richmond Gulf, Aug. 4, 1939, *J. Marr M392.*

DREPANOCLADUS FLUITANS (Hedw.) Warnst. QUEBEC: Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M307b.*

DREPANOCLADUS REVOLVENS (Turn.) Warnst. ONTARIO: South Twin Island, James Bay, July 22, 1935, *M. T. Doutt 2328c.* QUEBEC: Great Whale River, Aug. 10, 1935, *M. T. Doutt 2594b, 2621b;* Bill of Portland Island, Manitounuck Sound, Aug. 16, 1935, *M. T. Doutt 2662a, 2672a;* Manitounuck Sound, Aug. 14, 1939, *J. Marr M397c, M398a;* Beach Creek, Richmond Gulf, July 15, 1939, *J. Marr M361;* Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M384;* Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M328b.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, June 3, 1938, *J. K. Doutt 15b;* July 28, 1938, *J. K. Doutt 202b;* July 31, 1938, *J. K. Doutt 280a;* Aug. 1, 1938, *J. K. Doutt 295a;* Aug. 12, 1938, *J. K. Doutt 366a;* Sept. 12, 1938, *J. K. Doutt 362a;* Belcher Islands, Aug. 26, 1939, *J. Marr M426a, M431c, M433a;* Aug. 31, 1939, *J. Marr M453b;* Southampton Island, July 30, 1939, *M. E. Oldenburg 193.*

DREPANOCLADUS UNCINATUS (Hedw.) Warnst. ONTARIO: Hayes Island, Moose River, James Bay, June 23, 1935, *M. T. Doutt 2069a, 2070b;* June 28, 1935, *M. T. Doutt 2109a;* July 28, 1935, *M. T. Doutt 2112b.* QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M459a;* Great Whale River, Aug. 17, 1939, *J. Marr M401a;* Aug. 21, 1939, *J. Marr M410b, M415b;* Aug. 22, 1939, *J. Marr M414, M416a, M417b;* Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M300a, M301a, M306b;* July 8, 1939, *J. Marr M347a, M357;* Mainland south of Cairn Island, Richmond Gulf, July 6, 1939, *J. Marr M352a;* Fishing Lake Creek, Richmond Gulf, Aug. 3, 1939, *J. Marr M390b;* Wiachewan Bay, Richmond Gulf, July 17, 1939, *J. Marr M371c, M373c;* Cape Smith, Aug. 1, 1939, *M. E. Oldenburg 217A–a, 219B–b;* Wolstenholme, July 28, 1939, *M. E. Oldenburg 187a.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 28, 1938, *J. K. Doutt 205;* July 30, 1938, *J. K. Doutt 240;* July 31, 1938, *J. K. Doutt 277a;* Aug. 12, 1938, *J. K. Doutt 358b, 359, 364b;* Belcher Islands, Aug. 26, 1939, *J. Marr M423b, M429g, M436a;* Aug. 29, 1939, *J. Marr M442a;* Aug. 30, 1939, *J. Marr M449d.*

CALIERGON CORDIFOLIUM (Hedw.) Kindb. QUEBEC: Great Whale River, Aug. 10, 1935, *M. T. Doutt 2594a;* Wiachewan Bay, Richmond Gulf, July 17, 1939, *J. Marr M371b;* Cairn Island, Richmond Gulf July 28, 1939, *J. Marr M377;* Sugluk, July 26, 1939, *M. E. Oldenburg 157A.*

CALLIERGON GIGANTEUM (Schimp.) Kindb. NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M431c.*

CALLIERGON SARMENTOSUM (Wahlenb.) Kindb. QUEBEC: Great Whale River, Aug. 22, 1939, *J. Marr M418a;* Bill of Portland Island, Manitounuck Island, Aug. 16, 1935, *M. T. Doutt 2662c;* Manitounuck Sound, Aug. 14, 1939, *J. Marr M397d;* Cape Smith, Aug. 1, 1939, *M. E. Oldenburg 223.*

CALLIERGON STRAMINEUM (Brid.) Kindb. QUEBEC: Richmond Gulf, Aug. 5, 1939, *J. Marr M393b;* Wolstenholme, July 28, 1939, *M. E. Oldenburg 187b.*

CALLIERGON TRIFARIUM (Web. & Mohr) Kindb. QUEBEC: Bill of Portland Island, Manitounuck Sound, Aug. 16, 1935, *M. T. Doutt 2672c.*

CALLIERGON TURGESCENS (Schimp.) Lindb. NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 30, 1938, *J. K. Doutt 239b;* Belcher Islands, Aug. 26, 1939, *J. Marr M432b.*

SCORPIDIUM SCORPIOIDES (Hedw.) Limpr. ONTARIO: South Twin Island, James Bay, July 22, 1935, *M. T. Doutt 2328b, 2331.* QUEBEC: Great Whale River, Aug. 10, 1935, *M. T. Doutt 2621a;* Bill of Portland Island, Manitounuck Sound, Aug. 16, 1935, *M. T. Doutt 2672b.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M431a, M434.*

BRACHYTHECIACEAE

TOMENTHYPNUM NITENS (Hedw.) Loeske [*Camptothecium nitens* (Schreb). Schimp.] QUEBEC: Richmond Gulf, Aug. 5, 1939, *J. Marr M393a;* Cape Smith, Aug. 1, 1939, *M. E. Oldenburg 217A–c.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M436b.*

EURHYNCHIUM SERRULATUM (Hedw.) Kindb. ONTARIO: Hayes Island, Moose River, James Bay, June 28, 1935, *M. T. Doutt 2148b.*

EURHYNCHIUM STRIGOSUM (Hoffm.) Bry. Eur. ONTARIO: Hayes Island, Moose River, James Bay, June 22, 1935, *M. T. Doutt 2042b.*

BRACHYTHECIUM ALBICANS (Hedw.) Bry. Eur. ONTARIO: Hayes Island, Moose River, James Bay, June 22, 1935, *M. T. Doutt 2046.* QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M457a, M466a;* Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M304b;* Cape Smith, Aug. 1, 1939, *M. E. Oldenburg 217A–d.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 30, 1938, *J. K. Doutt 238c;* Aug. 1, 1938, *J. K. Doutt 294b.*

BRACHYTHECIUM RUTABULUM (Hedw.) Br. & Sch. ONTARIO: Hayes Island, Moose River, James Bay, June 28, 1935, *M. T. Doutt 2148a.*

BRACHYTHECIUM SALEBROSUM (Web. & Mohr) Bry. Eur. ONTARIO: Hayes Island, Moose River, James Bay, June 28, 1935, *M. T. Doutt 2109b, 2116c.*

ENTODONTACEAE

PLEUROZIUM SCHREBERI (Willd.) Mitt. [*Calliergonella Schreberi* (Bry. Eur.) Grout]. ONTARIO: Moose River, James Bay, June 23, 1935, *M. T. Doutt 2058c;* June 24, 1935, *M. T. Doutt 2100b;* South Twin Island, James Bay, July 23, 1935, *M. T. Doutt 2345b.* QUEBEC: Ft. George, Aug. 31, 1935, *M. T. Doutt 2759a;* Great Whale River, Aug. 21, 1939, *J. Marr M415c;* Manitounuck Sound, Aug. 14, 1939, *J. Marr M396e;* Wiachewan Bay, Richmond Gulf, July 16, 1939, *J. Marr M368b;* Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M336a.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, Aug. 12, 1938, *J. K. Doutt 354b, 356b.*

ORTHOTHECIUM CHRYSEUM (Schwaegr.) Bry. Eur. QUEBEC: Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M385c.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 28, 1938, *J. K. Doutt 202c;* Belcher Islands, Aug. 26, 1939, *J. Marr M426e;* Aug. 31, 1939, *J. Marr M453d.*

ORTHOTHECIUM INTRICATUM (Hartm.) Broth. QUEBEC: Beach Creek, Richmond Gulf, July 15, 1939, *J. Marr M360d.*

PLAGIOTHECIACEAE

PLAGIOTHECIUM DENTICULATUM (Hedw.) Bry. Eur. QUEBEC: Great Whale River, Aug. 17, 1939, *J. Marr M401b.*

PLAGIOTHECIUM FULCHELLUM (Hedw.) Bry. Eur. QUEBEC: Mainland south of Cairn Island, Richmond Gulf, July 5, 1939, *J. Marr M340a.*

PLAGIOTHECIUM ROSEANUM (Hampe) Bry. Eur. QUEBEC: Fishing Lake Creek, Aug. 1, 1939, *J. Marr M380c.*

PLAGIOTHECIUM SYLVATICUM (Brid.) Bry. Eur. QUEBEC: Cairn Island, Richmond Gulf, July 8, 1939, *J. Marr M346b.*

HYPNACEAE

HYPNUM CRISTA-CASTRENSIS Hedw. ONTARIO: Hayes Island, Moose River, James Bay, June 28, 1935, *M. T. Doutt 2113.*

HYPNUM CUPRESSIFORME Hedw. QUEBEC: Manitounuck Sound, Aug. 14, 1939, *J. Marr M395b.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 30, 1939, *J. Marr M444f.*

HYPNUM CURVIFOLIUM Hedw. NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M422b.*

HYPNUM FERTILE Sendt. ONTARIO: Hayes Island, Moose River, James Bay, June 28, 1935, *M. T. Doutt 2115.*

HYPNUM PATIENTIAE Lindb. ONTARIO: Hayes Island, Moose River, James Bay, June 28, 1935, *M. T. Doutt 2110b.*

RHYTIDIACEAE

RHYTIDIUM RUGOSUM (Hedw.) Kindb. QUEBEC: Manitounuck Sound, Aug. 14, 1939, *J. Marr M396a.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, Aug. 9, 1938, *J. K. Doutt 313b.*

RHYTIDIADELPHYS TRIQUETRUS (Hedw.) Warnst. ONTARIO: Hayes Island, Moose River, James Bay, June 23, 1935, *M. T. Doutt 2058a;* June 28, 1935, *M. T. Doutt 2114b.*

HYLOCOMIACEAE

HYLOCOMIUM SPLENDENS (Hedw.) Bry. Eur. ONTARIO: Moose River, James Bay, June 23, 1935, *M. T. Doutt 2058b;* South Twin Island, James Bay, July 23, 1935, *M. T. Doutt 2331.* QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M464b;* Great Whale River, Aug. 10, 1935, *M. T. Doutt 2600;* Manitounuck Sound, Aug. 14, 1939, *J. Marr M396d;* Mainland south of Cairn Island, Richmond Gulf, July 2, 1939, *J. Marr M318b;* Richmond Gulf, Aug. 5, 1939, *J. Marr M393c;* Fishing Lake Creek, Richmond Gulf, Aug. 3, 1939, *J. Marr M390c;* Cape Smith, Aug. 1, 1939, *M. E. Oldenburg 217A–b, 219B–a.*

POLYTRICHACEAE

POGONATUM ALPINUM (Hedw.) Röhl. QUEBEC: Seal River, Cape Jones, Sept. 3, 1939, *J. Marr M463;* Cairn Island, Richmond Gulf, July 2, 1939, *J. Marr M319a;* July 8, 1939, *J. Marr M345;* Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M379;* Mainland south of Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M322a, M335c.* NORTHWEST TERRITORIES: Belcher Islands, Aug. 26, 1939, *J. Marr M429h.*

POGONATUM CAPILLARE (Rich.) Brid. QUEBEC: Great Whale River, Aug. 21, 1939, *J. Marr M411;* Aug. 24, 1939, *J. Marr M419b;* Beach Creek, Richmond Gulf, July 15, 1939, *J. Marr M366.*

POLYTRICHUM COMMUNE Hedw. QUEBEC: Wiachewan Bay, Richmond Gulf, July 16, 1939, *J. Marr M368a;* Mainland south of Cairn Island, Richmond Gulf, July 3, 1939, *J. Marr M325b.*

POLYTRICHUM FORMOSUM Hedw. QUEBEC: Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M311a.*

POLYTRICHUM JUNIPERINUM Hedw. ONTARIO: Moose River, James Bay, June 24, 1935, *M. T. Doutt 2100a;* June 28, 1935, *M. T. Doutt 2108b;* South Twin Island, James Bay, July 23, 1935, *M. T. Doutt 2345a, 2372a;* Great Whale River, Aug. 24, 1939, *J. Marr M419a;* Wiachewan Bay, Richmond Gulf, July 16, 1939, *J. Marr M367;* Cairn Island, Richmond Gulf, June 29, 1939, *J. Marr M301b;* July 3, 1939, *J. Marr M329c, M338b;* Wiachewan Bay, Richmond Gulf, July 17, 1939, *J. Marr M372a;* Fishing Lake Creek, Richmond Gulf, Aug. 1, 1939, *J. Marr M383b;* Cape Smith, Aug. 1, 1939, *M. E. Oldenburg 222A–a.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, July 28, 1938, *J. K. Doutt 198a;* Aug. 12, 1938, *J. K. Doutt 356a, 357a;* Belcher Islands, Aug. 30, 1939, *J. Marr M445a, M452.*

POLYTRICHUM JUNIPERINUM var. ALPESTRE Bry. Eur. QUEBEC: Port Harrison, Aug. 2, 1939, *M. E. Oldenburg 239A–a.* NORTHWEST TERRITORIES: Tukarak Island, Belcher Islands, Aug. 12, 1938, *J. K. Doutt 354a.*

POLYTRICHUM PILIFERUM Hedw. QUEBEC: Great Whale River, Aug. 10, 1935, *M. T. Doutt 2598b;* Aug. 21, 1939, *J. Marr M409a;* Beach Creek, Richmond Gulf, July 15, 1939, *J. Marr M364a.*

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MOSSES COLLECTED BY THE ROBERT A. BARTLETT GREENLAND EXPEDITION 1940

INEZ M. HARING

The scientific collection of the Captain Robert A. Bartlett Greenland Expedition 1940 included mosses. These were given to Vassar College and subsequently sent to me for identification. The collection consisted of 69 packets, representing 23 genera and 40 species. In the following list the data is taken by permission from "Report of the Scientific Collecting Done in Labrador on the R. A. Bartlett Greenland Expedition 1940" and the "Report of the Scientific Collection Done in Greenland on the R. A. Bartlett Greenland Expedition 1940" by David C. Nutt. The mosses are listed in the order of collection.

"FIELD NOTES FOR W. TURNAVIK, LABRADOR . . . (Lat. 55° 15′ N., Long. 59° 20′ W.) a small outer island on the Labrador coast. There are no trees in the common sense although in sheltered places scrub *Picea*, *Salix*, and *Betula* may be found. The higher parts of the island are rocky and the lower parts are covered with a vegetation of moss, flowers, and grass, typically tundra in nature. There are about thirty small ponds on the island ranging from mere mud holes to the largest one which is about 300 yards long. The ponds were for the most part of rocky bottom. The seacoast was bold except in the sheltered harbour where a small stream flowed into a sheltered tide wash."

Here on July 6 David C. Nutt collected the following mosses:
Dicranum scoparium Hedw. probably. Not entirely true to form but probably due to arctic habitat.
Drepanocladus aduncus (Hedw.) Warnst. forma
Philonotis fontana Brid. var.
Rhacomitrium lanuginosum (Hedw.) Brid.

"FIELD NOTES FOR THOM ISLAND, MELVILLE BAY, GREENLAND. . . . Thom Island is a small island about a half a mile across and a little longer. The southern and eastern slopes held what little vegetation there was to be found and were virtually covered with the nests of the Eider Ducks . . . The island was teeming with life. There were no ponds to speak of, although ducks were seen feeding in one shallow mud hole."

Here on July 19 David C. Nutt collected:
Rhacomitrium lanuginosum (Hedw.) Brid.

"FIELD NOTES FOR CAPE YORK, GREENLAND. We ascended the northwest slope of the Cape, and it is interesting that here we encountered an utter dearth of vegetation. The whole Cape itself is one grand rock pile with the vegetation that dares to exist to be found around the lower margins. On the summit there was no evidence of life. This bold headland must see some violent wind and weather during the year; it is actually the 'Land of Desolation'."

Here on July 20, David C. Nutt collected:
Andreaea Blyttii Bry. Eur. forma
Drepanocladus uncinatus (Hedw.) Warnst.

Oncophorus virens (Hedw.) Brid.
Philonotis fontana (Hedw.) Brid. var. *heterophylla* Card. & Thér.
Pohlia Hedw. sp.
Pohlia proligera Lindb. The true species
Pohlia nutans (Hedw.) Lindb.
Rhacomitrium lanuginosum (Hedw.) Brid.

"FIELD NOTES FOR SURAT, CRIMSON CLIFFS, GREENLAND. During the afternoon of July 21 I was ashore at the Eskimo village of Surat . . . There was a little bight in the bold shore along Crimson Cliffs. Into this a small glacier and waterfall flowed. But for the most part the territory visited was along a straight, rock and moss-covered talus slope where the Little Auks nest in hundreds of thousands . . . As I expected the number of species of flowers and of birds encountered was limited, although of those we did see there was great abundance. This is due I believe to the fact that the Crimson Cliffs are in a bold straight shore with sea-facing cliffs; the ice cap in many places lops over on the top of the hills."

Here on July 21 David C. Nutt, Albert Barnes, R. Bartlett and Sam Bartlett collected:
Aulacomnium palustre (Web. & Mohr.) Schwgr.
Aulacomnium turgidum (Wahl.) Schwgr.
Bryum archangelicum Bry. Eur.
Bryum nitidulum Lindb.
Ceratodon purpureus (Hedw.) Brid.
Dicranum fragilifolium Lindb.
Dicranum laevidens Wms.
Dicranum strictum Schleich.
Drepanocladus uncinatus (Hedw.) Warnst.
Funaria hygrometrica (L.) Hedw. var. *arctica* Berggr.
Haplodon Wormskioldii (Hornem.) R. Br.
Hygrohypnum polare (Lindb.) Broth.
Mnium hymenophyllum B. & S.
Polytrichum commune Hedw. v. *yukonense* (Card. & Thér.) Frye
Pohlia nutans (Hedw.) Lindb.
Rhacomitrium lanuginosum (Hedw.) Brid.

FIELD NOTES are not given for THULE, GREENLAND.

Here on July 23, David C. Nutt collected:
Aulacomnium turgidum (Wahl.) Schwgr.
Calliergon sarmentosum (Wahl.) Kindb. Lacks usual color
Ceratodon purpureus (Hedw.) Brid. forma
Dicranum laevidens Wms.
Holmgrenia chrysea (Schwgr.) Lindb.
Oncophorus virens (Hedw.) Brid.
Philonotis fontana (Hedw.) Brid. v. *pumila* Brid. probably
Polytrichum juniperinum Hedw.
Rhacomitrium lanuginosum (Hedw.) Brid.
Rhacomitrium heterostichum (Hedw.) Brid. v. *Macounii* (Kindb.) Jones
Sphagnum fimbriatum Wilson
Tetraplodon mnioides (Hedw.) Bry. Eur.

"FIELD NOTES FOR ETAH AND VICINITY, GREENLAND. July 28–29 were spent anchored under Sunrise Point during a strong northerly wind. At 9 a. m. the whaleboat left the vessel for a journey to Etah and Foulke Fjord . . . and myself went ashore at Jensen Point. I travelled up onto the highland plains, and followed on over almost to Lifeboat Cove, then west out toward Cape Ohlsen and Littleton Island, thence back to Jensen Point . . . The flowers were abundant and varied."

Here on July 28–29, David C. Nutt collected:
Aulacomnium turgidum (Wahl.) Schwgr.
Calliergon sarmentosum (Wahl.) Kindb. forma
Dicranoweisia crispula (Hedw.) Lindb.
Drepanocladus aduncus (Hedw.) Warnst. v. *polycarpus* (Bland) Warnst. forma
Drepanocladus uncinatus (Hedw.) Warnst.
Ditrichum boreale (Wms.) Grout possibly
Districhium inclinatum (Hedw.) Bry. Eur. probably
Mnium hymenophyllum B. & S.
Philonotis fontana (Hedw.) Brid. forma probably
Pogonatum alpinum (Hedw.) Röhl. var. *arcticum* (Wahl.) Brid.
Rhacomitrium canescens Brid.

"FIELD NOTES FOR MARSHALL BAY, INGLEFIELD LAND (GREENLAND). At 1.30 a. m. August 2, 1940 we anchored in Marshall Bay. The first appearance of the place . . . was one of desolation,—very rocky shores, a river and a pond could be seen, and many rocks . . . It appears as if the bay region is surrounded by a rim of what I would like to call Inglefield Land Plateau which we could see from a hilltop we climbed. This plateau appears to be lovely rolling plains dissected by valleys, much like the country behind Etah. Inside this plateau is the bay region, which is the worst confused jumble of rocks I have ever laid eyes upon . . . In this bay region there is an utter scarcity of animal life . . . However, we did run across one rather nice valley with rich vegetation and a few ponds."

Here on August 2, David C. Nutt collected:
Aulacomnium turgidum (Wahl.) Schwgr.
Dicranum elongatum Schleich
Distichium Bry. Eur. possibly
Drepanocladus aduncus (Hedw.) Warnst. v. *polycarpus* (Bland) Warnst.
Calliergon Richardsoni (Mitt.) Kindb.
Haplodon Wormskioldii (Hornem.) R. Br.
Mnium hymenophyllum B. & S.
Philonotis fontana (Hedw.) Brid.
Rhacomitrium canescens Brid. appr. f. *epilosum* (Milde) Jones
Rhacomitrium lanuginosum (Hedw.) Brid.
Rhacomitrium heterostichum (Hedw.) Brid. v. *sudeticum* (Funck) Jones

I wish to express my very great appreciation to Dr. A. J. Grout for many identifications and for the checking of all of my own identifications, also to Dr. A. LeRoy Andrews, Dr. T. C. Frye, Miss Irma Schnooberger and Dr. A. J. Sharp for their identification of some of

the species. Complete sets of these mosses have been sent to Dr. A. J. Grout, Vassar College and the Smithsonian Institute.

ALUMNAE HOUSE
POUGHKEEPSIE, NEW YORK

MOSSES OF LABRADOR

MILDRED L. WICKES

When my work on a survey of the mosses of Allegany State Park was completed, I had developed such an interest in mosses that I consulted Dr. Grout concerning other collecting fields. He suggested that we work on a Labrador collection. I was much intrigued with the idea of a trip into the North and decided at once to investigate the possibilities.

Little did I realize the difficulties that would confront me in undertaking such a collecting task, nor, alas, the expenses involved. In June, 1938, having obtained what information I could from the Newfoundland Tourist Bureau, and greatly helped by advice from Dr. Stanley Truman Brooks, Curator of Recent Invertebrates in Carnegie Museum in Pittsburgh, I started out jubilantly to do my first summer of collecting in the Labrador. Dr. Brooks had spent three summers in the country and was conversant with the difficulties involved. Had it not been for his advice, I should have made little progress on my first trip.

I drove my car to North Sydney, Nova Scotia, crossed Newfoundland by the wandering, narrow-gauge railway—which seems to have been built around every obstruction rather than through it—and arrived in St. John's, Newfoundland, early in July.

In St. John's I waited two weeks for the boat to take me up the Labrador coast. To while away the time and to save expense in the Newfoundland Hotel, I boarded with Mrs. Williams in a little fishing village called Bay of Bulls. In the vicinity of this village and around St. John's I was able to do a little collecting. Anyone who has had any experience with the transportation facilities of Newfoundland will understand why I was not too successful during my first two weeks there. The list of species which follows shows a few mosses from Newfoundland. Unless so indicated all the species are from the Labrador.

At last the "Kyle" arrived. She is a freight and mail steamer and affords the only means of getting down along the eastern coast of Labrador. The schedule calls for one week to get down the coast as far as Hopedale and another week to return. This time, I found, is entirely problematical, depending upon the freight and the weather. In a fog, and there is plenty of that, or on a moonless night there is often nothing to do but anchor or move round and round in a circle.

The coast is open to navigation from early July to September or early October. The "Kyle" goes much shorter distances north on the later trips. This, and the fact that I had to be home in early September, limited my collecting activities to July and August.

Dr. Grout helped me to plan my work and it is our idea that several summer trips shall be undertaken. In the summer of 1939, illness in my family kept me at home. So far, I have made two trips, one in 1938 and one in 1940. The last trip was further complicated by war regulations, which involved permission from Washington and from the Newfoundland Government, as well as the matter of a passport. It was also impossible to learn the sailing dates of the boat, which added to the expenses.

All further work is, of course, at a standstill "for the duration," but I have learned to love the grey Labrador and my work there and we plan that I shall make other trips as soon as possible.

Labrador is a great peninsula embracing some 511,000 square miles. It extends from 50° to 63° N. Lat. and from 55° to 80° W. Long. It was heavily glaciated and subjected to a very long period of inundation. The country is now a great plateau which rises quickly from the coast to elevations of from 300 to 2000 feet. There are peaks as high as 8000 feet. A range of mountains extends along the Atlantic coast from the Straits of Bell Isle to Cape Chidley. The elevation of these mountains is not much over 2000 feet except for the numerous peaks. The Atlantic coast is deeply indented with bays and fiords and fringed with countless islands. Navigation is extremely difficult. The Captain and officers of the "Kyle" have been on the coast for many years and literally know it by heart.

The surface of the plateau near the coast is seamed with valleys through which icy streams filled with waterfalls and rapids descend with great rapidity. Much of the drainage is northward.

The rocks, so far as I could observe, are mostly igneous; schists, gneisses and granites, although I saw some limestone. At Battle

Harbor I went ashore with the mail boat and collected a few species on limestone rock, but was able to spend only a half hour there.

I have endeavored, by means of a small map (fig. 1), to give some idea of the areas where I collected; and I shall now describe briefly the conditions which I found in each area.

I went first to Northwest River. This town lies at the head of Lake Melville and is about 250 miles north of Bell Isle. The Lake is a

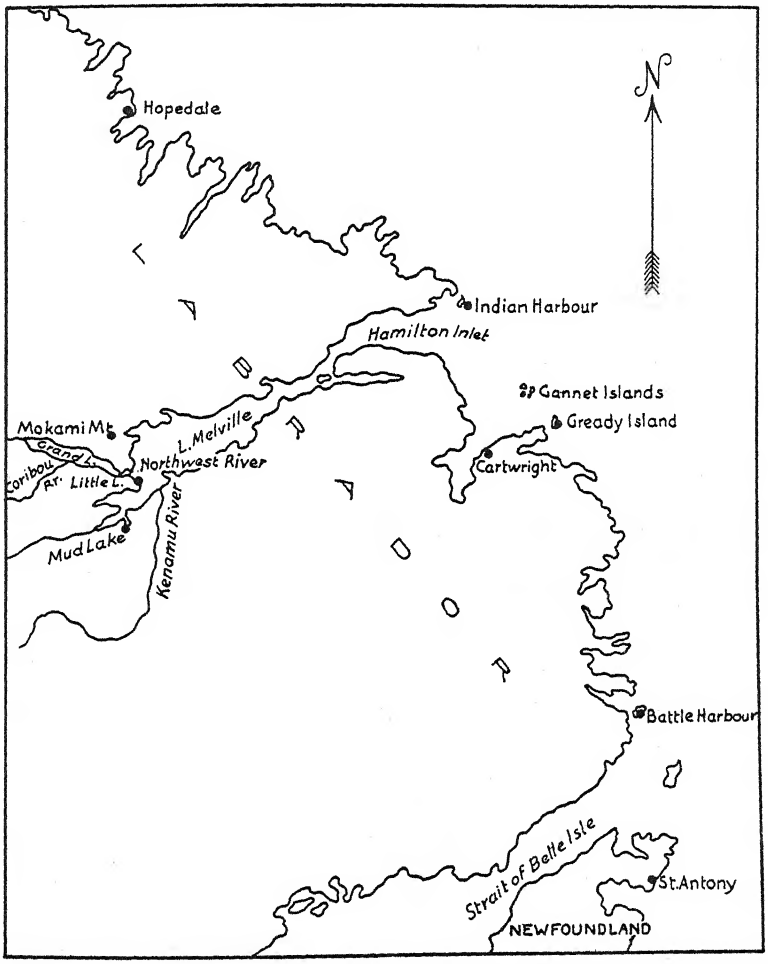

Figure 1. Map of eastern Labrador.

continuation of Hamilton Inlet, and the town lies at least 150 miles inland from the coast. Lake Melville, on the side opposite the town, is nearly fresh water. On the town side it has a slightly salty taste. It is, in places, as wide as thirty miles and as narrow as two miles. Two fresh-water lakes lie northwest of the town; Little Lake, about five miles in length, and Grand Lake, about thirty-five miles in length. The two lakes are connected by a small rapid. Little Lake has areas of swale grass about its shores. Emptying into Grand Lake on the southern side is the Caribou River. Near the head of Lake Melville and emptying into it is the Kenamu River. On the northern shore of Lake Melville and about thirty miles from Northwest River is Mokami Mountain. Here the elevation is 1590 feet. This is the highest elevation which I have, so far, been able to examine.

I quickly discovered that it is impossible to do any collecting in the Labrador without a boat. The boats which I was able to hire are small, inboard motor boats. The gasoline engines are one or two cylinders and the fuel execrable. To go out thirty miles and return takes the better part of a day. The service is fairly expensive and very difficult to obtain. Trying to walk, one quickly finds the way cut off by little, swift streams, swamps and bogs.

Northwest River is built on solid sand but outside the town the country is heavily wooded. The forest is black spruce with fir and larch. The trees are self-pruned with plenty of interlacing stubs. To force one's way through is exhausting and difficult work. The burned-over areas are covered with white birch, poplar and aspen.

To reach the top of Mokami Mountain it was necessary to travel down Lake Melville by motor boat and up the Micmac River by canoe. Here we had to traverse two rapids to the foot of a waterfall, where we left our canoe. I climbed the mountain in hip-boots. At the foot we waded knee-deep through a mile of bog, then ascended through spruce forest to timber line. The way was barred by wet cliffs covered with treacherous moss up which the guides hauled me by my arms and down which I slid, in returning, on the seat of my pants.

The black flies were a great hindrance to my work. The farther north I got, the worse they were. There is no keeping them out. I wore heavy socks and hip-boots, banded my shirts at the wrist with rubber bands, covered my head with a net, fastened clothing with zippers, and still they got at me. I swelled up until my ears stuck out,

my chest looked like raw beef and my eyes were partly closed. If there is any kind of dope those flies don't like, I failed to find it.

At the mouth of the Hamilton River is a small lake called Mud Lake. I did not fully collect its shores but did some work there.

The "Kyle" goes to Northwest River only twice each summer, so my time there was limited to less than three weeks. On the trip out I left the "Kyle" at Indian Harbor and was able to collect there for three days until the boat returned from the trip north to Hopedale.

Indian Harbor is an island in the mouth of Hamilton Bay, where there is a fishing station and a Grenfell nursing post in the summer. I ate with the nurse and used my sleeping bag on the floor of an abandoned hospital. The island has an uneven surface of rocks and boulders. It is treeless and is covered with an arctic vegetation of flowering plants, including sedges and some prostrate willow. The centre of the island is a bog.

In 1940 I stopped first at Cartwright on Sandwich Bay where I spent a delightful two weeks with the Moores. Mr. Moore is chief Marconi Operator on the coast. Cartwright is really a coastal town which is surrounded by barren hills with wooded sections in the background. Most of my collecting here was done at sea level, though I did get on top of Blackhead Hill. I could not find out its exact elevation but it is certainly not more than 500 feet.

While at Cartwright I was able to hire a tiny, inboard motor boat and in it I visited two islands.

Grady Island is a Newfoundland fishing station and is about ten miles off the coast of Cape North and to the south of Cartwright. It was an old whaling station and the remains of the whaling plant still stands. It is a treeless, rocky island with a large pond in the centre. The pond has its outlet in a running brook with a stony bottom. The rocks and boulders of the island are overlaid with the usual arctic vegetation.

The Gannet Islands are piles of rock thirty miles off shore in the Atlantic. We were lucky to draw a clear day and night for they are difficult to locate in a fog. I am told that no one knows how many islands make up the group. They are uninhabited except for nesting birds, which literally darken the sky when they rise into the air. A raincoat and hat were a real necessity while ashore. Much of the rocky surface was uncovered by any vegetation but there were some

grassy and sandy stretches. I saw no water except pools of rain water and some boggy spots.

Leaving Cartwright, I went north to Hopedale in Adlitok Bay. Here is a station of the Moravian Mission where I was able to stay. The population of Hopedale, outside the family of the Missionary, the Marconi Operator, the Ranger and the staff of the Hudson Bay Post, is Eskimo together with many of mixed blood. The country is treeless except for a few coulées where there is a stunted growth. In August, snow still lay in sheltered places. All about the town are barren, boulder-strewn hills covered with a spongy mass of wet vegetation, containing many lovely flowers, twisted, vine-like willow, blueberry, heaths and lichens. There are many bogs between the low hills, which reach an elevation of perhaps, 300 to 400 feet. It was a very difficult place to collect because of the fogs which come in without warning and the danger of getting lost. Behind the first hill all landmarks vanished. A compass was of little help. I carried a signal gun and a dog stick and never stooped to a moss without first looking all about me.

The "Kyle" goes no farther north than Hopedale. On my next summer trip I hope to charter the Diesel-powered boat of the Grenfell station at Northwest River. It is large enough to live aboard and will be able to take me to the north and into many inaccessible lakes and fiords. I feel that my collecting work in Labrador has only begun.

I wish to offer my thanks to Dr. Grout for allowing me to share this work with him, for his inspiration and encouragement, and for his work in identifying the species. I wish also to thank Dr. H. L. Blomquist for verification of the *Sphagna*.

LIST OF SPECIES

AMBLYSTEGIUM JURATZKANUM Schimp. On rocks, Grady Island, July, 1940.

AMBLYSTEGIUM SERPENS (Hedw.) Bry. Eur. On rocks, Grady Island, July, 1940.

ANDREAEA ROTHII Web. & Mohr. On rocks, Gannet Islands, July, 1940.

ANDREAEA RUPESTRIS Hedw. On boulders in woods, Northwest River, Aug., 1938.

ANDREAEA RUPESTRIS Hedw. var. ACUMINATA Bry. Eur. On rocks, top of Blackhead Hill, Cartwright, July, 1940; on rocks, Hopedale, Aug., 1940.

ANDREAEA RUPESTRIS Hedw. var. ALPESTRIS Thed. On rocks, Hopedale, Aug., 1940.

ARCTOA STARKEI (Web. & Mohr) Grout. On rocks, Hopedale, Aug., 1940.

AULACOMNIUM PALUSTRE (Web. & Mohr) Schwaegr. On rocks, Grady Island, July, 1940; wet floor of coulée, Hopedale, Aug., 1940; on rocks, Indian Harbor, Aug., 1938.

AULACOMNIUM TURGIDUM (Wahl.) Schwaegr. On rocks, Indian Harbor, Aug., 1938; on rocks, Gannet Islands, July, 1940.

BARBULA REFLEXA (Brid.) Brid. On rocks, Battle Harbor, July, 1938.

BARTRAMIA BREVISETA Lindb. On rocks, Gannet Islands, July, 1940; on rocks, Grady Islands, July, 1940.

BARTRAMIA ITHYPHYLLA Brid. On rocks, Hopedale, Aug., 1940.

BLINDIA ACUTA (Hedw.) Bry. Eur. On rocks, Hopedale, Aug., 1940.

BRACHYTHECIUM BESTII Grout. On bark of fir tree, Northwest River, July, 1938.

BRACHYTHECIUM FLAGELLARE (Hedw.) Jennings. On boulders in stream, Bay of Bulls, Newfoundland, July, 1938.

BRACHYTHECIUM GLAREOSUM (Bruch.) Bry. Eur. On leaves in Little Lake Run, Northwest River, July, 1938.

BRACHYTHECIUM OXYCLADON (Brid.) Jaeger & Sauerb. On bark of tree, St. John's, Newfoundland, Aug., 1938.

BRACHYTHECIUM RIVULARE Bry. Eur. On wet stones in creek, Northwest River, July, 1938; wet soil in woods, Hopedale, Aug. 1940.

BRYUM ARCHANGELICUM Schimp. In crevices of rocks, Grady Island, July, 1940; in crevices of rock, Gannet Islands, July, 1940.

BRYUM CAESPITICIUM Hedw. On soil along Burdette Creek, July, 1940.

BRYUM INCLINATUM (Sw.) Bland. On rocks, Gannet Islands, July, 1940.

BRYUM PSEUDOTRIQUETRUM (Hedw.) Schwaegr. On rocks, Hopedale, Aug., 1940.

BRYUM PURPURASCENS Kindb. On wet soil along Little Lake, Northwest River, July, 1938.

CALLIERGIDIUM PSEUDOSTRAMINEUM (C. Müll.) Grout. Banks Big Brook, Northwest River, July, 1938.

CALLIERGON CORDIFOLIUM (Hedw.) Kindb. On clay, shores Mud Lake, Northwest River, July, 1938; on rocks, Grady Island, July, 1940.

CALLIERGON SARMENTOSUM (Wahlenb.) Kindb. Banks Big Brook, Northwest River, July, 1938; in water, Hopedale, Aug., 1940. Note: Dr. Grout states that there are no apiculate leaves in my Labrador specimens.

CALLIERGON STRAMINEUM (Brid.) Kindb. Submerged in bog, St. John's, Newfoundland, July, 1938; wet soil, Hopedale, Aug., 1940; wet soil, Cartwright, July, 1940.

CALLIERGONELLA SCHREBERI (Bry. Eur.) Grout. Patches on forest floor, Northwest River, Aug., 1938.

CAMPYLIUM CHRYSOPHYLLUM (Brid.) Bryhn. On stone base of Post Office, Wittless Harbor, Newfoundland, July, 1938.

CAMPYLIUM POLYGAMUM (Bry. Eur.) Bryhn. In grass along sandy beaches, Lake Melville, July, 1938.

CERATODON PURPUREUS (Hedw.) Brid. Sandy bank, Kenamu River, July, 1938; on decaying wood, Cartwright, July, 1940; on rocks, Grady Island, July, 1940.

CERATODON PURPUREUS (Hedw.) Brid. forma ARISTATUS (Aust.) Britton. On rocks, Grady Island, July, 1940.

CLIMACIUM DENDROIDES (Hedw.) Web. & Mohr. On damp soil, Grand Lake, July, 1938.

CONOSTOMUM BOREALE Sw. On bank of Jackies Creek, Cartwright, July, 1940.

DESMATODON LATIFOLIUS (Hedw.) Brid. On rocks, Gannet Islands, July, 1940; on rocks, Grady Islands, July, 1940.

DICRANELLA CERVICULATA (Hedw.) Schimp. Along drainage ditches, Cartwright, July, 1940; on sandy bank, Kenamu River, July, 1938.

DICRANELLA SCHREBERI (Hedw.) Schimp. On moist soil, Mud Lake, July, 1938.

DICRANELLA SUBULATA (Hedw.) Schimp. On boulder in woods, Northwest River, July, 1938.

DICRANOWEISIA CRISPULA (Hedw.) Lindb. On rocks, shore of Grand Lake, July, 1938.

DICRANUM ARCTICUM Schimp. In bog, Indian Harbor, Aug., 1938; on rocks, Hopedale, Aug., 1940.

DICRANUM BONJEANI DeNot. On limestone rocks, Battle Harbor, July, 1938.

DICRANUM CONDENSATUM Hedw. On decaying wood in bog, Hopedale, Aug., 1940.

DICRANUM ELONGATUM Schleich. In wet openings of caves under layers of *Sphagnum*, Grand Lake, July, 1938; bank of Jackies Brook, Cartwright, July, 1940; soil in bog, Hopedale, Aug. 6, 1940.

DICRANUM FUSCESCENS Turn. On base of fir tree, Northwest River, July, 1938; on rocks, top of Blackhead, Cartwright, July, 1940; on decaying wood in bog, Hopedale, Aug., 1940.

DICRANUM GROENLANDICUM Brid. On rocks, Grady Island, Aug., 1940.

DICRANUM MAJUS Smith. Wet soil in swamp, Mud Lake, July, 1938.

DICRANUM SCOPARIUM Hedw. On damp soil, Hopedale, Aug., 1940.

DICRANUM SCOPARIUM Hedw. var. ORTHOPHYLLUM Brid. On wet soil, Big Pond, Newfoundland, July, 1938.

DICRANUM SPADICEUM Zett. On rocks, Indian Harbor, Aug., 1938; on rocks, top of Blackhead, Cartwright, July, 1940.

DIDYMODON RECURVIROSTRIS (Hedw.) Jenn. On alder roots, Mud Lake, Northwest River, July, 1938; on rocks, Grady Island, July, 1940.

DIPHYSCIUM FOLIOSUM (Hedw.) Mohr. On soil in woods, Bay Bulls, Newfoundland, July, 1938.

DISTICHIUM CAPILLACEUM (Hedw.) Bry. Eur. On wet soil under boulders, Indian Harbor, Aug., 1938; on soil, top of Blackhead, Cartwright, July, 1940.

DISTICHIUM INCLINATUM (Hedw.) Bry. Eur. On rocks, Grady Island, July, 1940.

DREPANOCLADUS ADUNCUS (Hedw.) Warnst. var. KNEIFFII (Bry. Eur.) Warnst. In swale grass, Mud Lake, July, 1938.

DREPANOCLADUS ADUNCUS (Hedw.) Warnst. var. KNEIFFII (Bry. Eur.) Warnst., forma INTERMEDIUS (Bry. Eur.) Mönkem. In running, icy water under snow, Hopedale, Aug., 1940.

DREPANOCLADUS EXANNULATUS (Gümb.) Warnst. In bog, Indian Harbor, Aug., 1938; in pool of rain water, Gannet Islands, July, 1940.

DREPANOCLADUS EXANNULATUS (Gümb.) Warnst. var. BRACHYDICTYUS (Ren.) Grout. On wet stones, Indian Harbor, Aug., 1938.

DREPANOCLADUS EXANNULATUS (Gümb.) Warnst. forma FALCIFOLIUS (Ren.). On rocks, Grady Island, July, 1940.

DREPANOCLADUS EXANNULATUS (Gümb.) Warnst. var. ROTAE (DeNot) Grout. Submerged in pool on steep hillside above Little Lake, July, 1938.

DREPANOCLADUS EXANNULATUS (Gümb.) Warnst. forma SUBMERSUS Mönkem. In running, icy water, Grand Lake, Aug., 1938; submerged in pool, foot Blackhead Hill, Cartwright, July, 1940.

DREPANOCLADUS FLUITANS (Hedw.) Warnst. Submerged in bog, Long Pond, Newfoundland, July, 1938; submerged in pool, Cartwright, July, 1940; submerged in bog, foot of Blackhead Hill, Cartwright, July, 1940.

DREPANOCLADUS FLUITANS (Hedw.) Warnst. forma GRACILIS (Boul.). On stones in Burdette Brook, Cartwright, July, 1940.

DREPANOCLADUS FLUITANS (Hedw.) Warnst. forma JEANBERNATI (Ren.) Mönkem. In bog, Cartwright, July, 1940; on stones in running water, Grady Island, July, 1940.

DREPANOCLADUS FLUITANS (Hedw.) Warnst. forma SETIFORMIS (Ren.) Mönkem. Submerged in pool in swamp, Northwest River, July, 1938.

DREPANOCLADUS REVOLVENS (C. Müll.) Warnst. In bog, Indian Harbor, Aug., 1938.

DREPANOCLADUS SENDTNERI (Schimp.) Warnst. In bog, Cartwright, July, 1940.

DREPANOCLADUS UNCINATUS (Hedw.) Warnst. In bog, Indian Harbor, Aug., 1938; on soil in woods along Burdette Brook, Cartwright, July, 1940; on rocks, Grady island, July, 1940; in edge of pool, Gannet Islands, July, 1940; on rocks, Hopedale, Aug., 1940.

DREPANOCLADUS UNCINATUS (Hedw.) Warnst. var. PLUMOSUS (Schimp.) Ren. On soil in woods, Northwest River, July, 1938.

DREPANOCLADUS UNCINATUS (Hedw.) Warnst. var. SYMMETRICUS (Ren. & Card.) Grout. On rocks, Grady Island, July, 1940.

DREPANOCLADUS VERNICOSUS (Lindb.) Warnst. On wet soil, Grand Lake, July, 1938; on rocks, Grady Island, July, 1940; on rocks, Gannet Islands, July, 1940.

FONTINALIS DALECARLICA Bry. Eur. On rocks, submerged, Burnt Brook, Aug., 1938; Jackies Brook, Cartwright, July, 1940; on rocks, Grady Island, July, 1940.

FUNARIA HYGROMETRICA Hedw. Hospital grounds, Cartwright, July, 1940.

GRIMMIA MARITIMA Turn. On rocks, Gannet Islands, July, 1940.

GRIMMIA OLNEYI Sull. On rocks, Bay Bulls, Newfoundland, July, 1938.

HYGROHYPNUM MOLLE (Schimp.) Loeske. On stones, submerged, Caribou River, July, 1938.

HYGROHYPNUM OCHRACEUM (Turn.) Loeske. On rocks, submerged, Burnt Brook, Aug., 1938; on boulders, Jackies Brook, Cartwright, July, 1940; on rocks in stream, Grady Island, July, 1940.

HYLOCOMIUM SPLENDENS (Hedw.) Bry. Eur. Patches on forest floor, Northwest River, July, 1938.

HYPNUM CRISTA-CASTRENSIS Hedw. Covering forest floor, Northwest River, July, 1938.

HYPNUM PATIENTIAE Lindb. In moist sand along Little Lake, July, 1938.

HYPNUM SUBPLICATILE (Lindb.) Limpr. Base fir tree, Northwest River, July, 1938; on soil, Hopedale, Aug., 1940.

LEPTOBRYUM PYRIFORME (Hedw.) Schimp. On roots alder bushes, Little Lake, July, 1938; on soil, Cartwright, July, 1940; on rocks, Grady Island, July, 1940.

LEPTODICTYUM RIPARIUM (Hedw.) Warnst. forma LONGIFOLIUM (Schultz). On moist earth under rocks, Hopedale, Aug., 1940.

MEESIA TRIQUETRA (Hook & Tayl.) Angstr. In swale grass, Little Lake, July, 1938.

MNIUM CINCLIDIOIDES (Blytt.) Hüben. Below dam, Burdette Brook, Cartwright, July, 1940.

MNIUM PUNCTATUM Hedw. On wet banks, Northwest River, July, 1938.

MNIUM PUNCTATUM Hedw. var. SUBGLOBOSUM Hampe. In cave under stream, Grady Island, July, 1940.

ONCOPHORUS POLYCARPUS (Hedw.) Brid. var. STRUMIFERUS (DeNot) Grout. On decaying wood, Cartwright, July, 1940.

ONCOPHORUS TENELLUS (Bry. Eur.) Williams. On rocks, Blackhead Hill, Cartwright, July, 1940.

ONCOPHORUS VIRENS (Hedw.) Brid. var. SERRATUM (Bry. Eur.) Limpr. On rocks, Blackhead Hill, Cartwright, July, 1940.

ONCOPHORUS WAHLENBERGII Brid. On wet cliff, Grand Lake, July, 1938; in bog, Hopedale, Aug., 1940.

PALUDELLA SQUARROSA (Hedw.) Brid. In bog, Indian Harbor, Aug., 1938; in bog, Hopedale, Aug., 1940.

PARALEUCOBRYUM LONGIFOLIUM (Hedw.) Loeske. On decaying log, St. John's, Newfoundland, Aug., 1938.

PLAGIOTHECIUM DENTICULATUM (Hedw.) Bry. Eur. In wet hollows, Hopedale, Aug., 1940; on soil, Grady Island, July, 1940.

PLAGIOTHECIUM LAETUM Bry. Eur. Floor of wet cave, Grand Lake, Aug., 1938.

PLAGIOTHECIUM LATEBRICOLA (Wils.) Bry. Eur. Bark birch tree, Grand Lake, Aug., 1938.

PLAGIOTHECIUM TURFACEUM (Lindb.) Lindb. Bark birch tree, Grand Lake, Aug., 1938.

POGONATUM ALPINUM (Hedw.) Röhl. var. ARCTICUM (Wahl.) Brid. On base dam, Burdette Brook, Cartwright, July, 1940.

POGONATUM ALPINUM (Hedw.) Röhl. var. BREVIFOLIUM Brid. On rocks, Grady Island, July, 1940.

POGONATUM ALPINUM (Hedw.) Röhl. var. MACOUNII (Kindb.) Card. & Thér. On soil, Grand Lake, July, 1938.

POGONATUM CAPILLARE (Rich.) Brid. On sandy bank, Kenamu River, July, 1938;

POHLIA ACUMINATA Hoppe & Hornsch. On rocks, Gannet Islands, July, 1940.

POHLIA CRUDA (Hedw.) Lindb. On rocky soil, Grand Lake, July, 1938; on soil, Little Lake, July, 1938.

POHLIA NUTANS (Schreb.) Lindb. Crevices in rock, Blackhead Hill, Cartwright, July, 1940; on rocks, Hopedale, Aug., 1940; in swamp, Northwest River, July, 1938.

POHLIA SCHIMPERI (C. Müll.) Andrews. On sides drainage ditches, Cartwright, July, 1940.

POLYTRICHUM COMMUNE Hedw. On Hospital grounds, Cartwright, July, 1940.

POLYTRICHUM JUNIPERINUM Hedw. On cement dam, Burdette Brook, Cartwright, July, 1940.

POLYTRICHUM PILIFERUM Hedw. On sandy bank, Kenamu River, July, 1938.

POLYTRICHUM STRICTUM Brid. On rocks, Indian Harbor, Aug., 1938.

POTTIA HEIMII (Hedw.) Fürnr. On rocks, Grady Island, July, 1940.

PYLAISIA SELWYNII Kindb. On base of tree, St. John's, Newfoundland, Aug., 1938.

RHACOMITRIUM CANESCENS Brid. var. EPILOSUM Milde. On rocky ledge, Grand Lake, July, 1938.

RHACOMITRIUM FASCICULARE (Hedw.) Brid. On rocks, Grady Island, July, 1940.

RHACOMITRIUM HETEROSTICHUM (Hedw.) Brid. var. RAMULOSUM (Lindb.) Jones. On boulder in woods, Northwest River, Aug., 1938; on rocks, Blackhead Hill, Cartwright, July, 1940; on rocks, Jackies Brook, Cartwright, July, 1940.

RHACOMITRIUM HETEROSTICHUM (Hedw.) Brid. var. SUDETICUM (Funck) Jones. On rocks, Hopedale, Aug., 1940.

RHACOMITRIUM LANUGINOSUM (Hedw.) Brid. On top Mokami Mountain, Aug., 1938.

RHYTIDIADELPHUS LOREUS (Hedw.) Warnst. On woods floor, Bay Bulls, Newfoundland, July, 1938.

RHYTIDIADELPHUS SQUARROSUS (Hedw.) Warnst. Wet soil along creek, Burnt Brook, July, 1938.

RHYTIDIADELPHUS TRIQUETRUS (Hedw.) Warnst. On decayed wood and leaves in swamp, Caribou River, July, 1938.

SPHAGNUM CAPILLACEUM (Weiss) Schrank. In bog, Grand Lake, July, 1938.

SPHAGNUM CAPILLACEUM (Weiss) Schrank var. TENELLUM (Schimp.) Andrews. In swamp, Little Lake, July, 1938.

SPHAGNUM COMPACTUM DC. On top Mokami Mountain, Aug., 1938.

SPHAGNUM FUSCUM (Schimp.) H. Klingr. On rocks, Grady Island and Gannet Islands, July, 1940.

SPHAGNUM GIRGENSOHNII Russow. Wet hillside, Little Lake, July, 1938.

SPHAGNUM LINDBERGII Schimp. In bog, Grand Lake, July, 1938.

SPHAGNUM PAPILLOSUM Lindb. On rocks and soil, Hopedale, Aug., 1940.

SPHAGNUM RIPARIUM Ångstr. In swale grass, Big Brook, July, 1938.

SPHAGNUM SQUARROSUM Crome. Big Brook, Northwest River, July, 1938.

SPLACHNUM OVATUM Hedw. On woods path, Hopedale, July, 1940.

TETRAPLODON MNIOIDES (Hedw.) Bry. Eur. On sewage-soaked wood near Indian camp, Caribou River, July, 1938; back of Eskimo hut, Hopedale, Aug., 1940; in Hospital grounds, Cartwright, July, 1940.

TREMATODON AMBIGUUS (Hedw.) Hornsch. On soil, border Long Lake, Newfoundland, July, 1938; in woods, Cartwright, July, 1940.

ULOTA LUDWIGII Brid. On bark of trees, St. John's, Newfoundland, July, 1938.

ULOTA PHYLLANTHA Brid. On rocks, Gannet Islands, July, 1940.

27 GROVE ST.,
TONAWANDA, NEW YORK

CLADONIA SUBCARIOSA AND ITS FORMS

W. L. DIX

Cladonia subcariosa Nyl. has the following recognized forms: f. *epiphylla,* with no podetia, and apothecia sessile on the primary squamules; f. *squamulosa,* with squamulose podetia; f. *evoluta,* usually unbranched, and with one or few apothecia; f. *pleurota,* having many apical, sessile or short stipitate apothecia; f. *pallida,* with whitish apothecia; f. *sorediosa,* which has soredia on the primary squamules; f. *subascyphosa,* characterized by more or less distinct narrow cups; and f. *descendens,* with podetia only 1 to 3 mm. high and 0.5 to 1 mm. in diameter.

These forms seem to ignore a very large population of branched and proliferate specimens which appear to be reducible to three general types. First, a form that *divides* at the apex of the podetia into 4–many short branches, often having a cup-like appearance similar to that of *C. cristatella* f. *scyphulifera;* next a form with many *adventive* branches, usually near the apex of the podetia; and third, a form in which the podetia are usually decumbent, with many outgrowths along the upper side, varying in length from 5 mm. to 15 mm. Many forms intermediate between these appear, but the typical forms are quite distinct.

The first of these forms seem to result from a natural branching of the podetia; the last two have proliferate branches similar to those in the Cladinae. Generally these forms are without squamules and nearly always bear apothecia, but they may be occasionally squamulose and without apothecia.

Though it does not seem wise to burden the literature of the *Cladoniae* with a separate name for each of the three forms described above, yet this whole group of branched and proliferate forms may well be placed in a distinct classification under one name. This group would then be analogous to that already recognized under *C. clavulifera* f. *subfastigiata.*

I therefore propose the following:

Cladonia subcariosa f. **ramosa** f. nova, podetia aut multis ramis similitudine scyphi apice divisa, aut multis ramulis in lateribus et apud apicem et in podetiis prostratis enatis.

Collections of the above described form were made near Washington's Crossing, New Jersey, in 1942. Type specimens are in the herbarium of the Osborn Botanical Laboratory in New Haven, Connecticut, Nos. 1097 and 1100.

801 CROWN ST.,
MORRISVILLE, PENNSYLVANIA

THE SULLIVANT MOSS SOCIETY IN 1942

The Secretary-Treasurer, Dr. Winona H. Welch, reports 21 new members.

Total membership, personal	230
institutional	85

These numbers vary from day to day.

Balance on hand January 1, 1942	$1.90
" " " December 23, 1942	320.74
Total receipts 1942	1098.17
Total expenditures 1942	777.43
Gifts (not including expenses donated by officers)	52.20
Aid from members and institutions in publishing certain articles	139.27

The Curator of Hepatics, Dr. Margaret Fulford, reports 722 packets of Hepatics received, including 247 from the vicinity of Washington, D. C., sent in by Miss Haynes, 160 collected in eastern Canada, sent in by Dr. Roy F. Cain, and 61 from Dr. Frye and Miss Clark.

The Curator of Mosses, Dr. L. E. Anderson, has been absent serving in the Navy. Dr. H. J. Oosting, left in charge of Dr. Anderson's affairs, reports that 1173 specimens were placed in the herbarium, giving a total of 10,154 specimens. About ten donors were represented.

The Curator of Lichens, Dr. C. W. Dodge, reports that about a dozen specimens were added during the year.

The Director of the Hepatic Exchange, Dr. A. J. Sharp, reports:

499 packets received.

583 packets sent out in exchange.

4 lists of material for exchange issued, and 1 list of accumulated packets.

19 active members.

The Director of the Moss Exchange, Dr. R. T. Wareham, reports:

2,845 packets received.

2,936 packets distributed.

4 lists of material for exchange issued.

23 active members Jan. 2, 1943.

The Foray at Douglas Lake, Mich., was successfully held. The annual meeting in December was deferred on account of the war.

HENRY S. CONARD, *Pres.*

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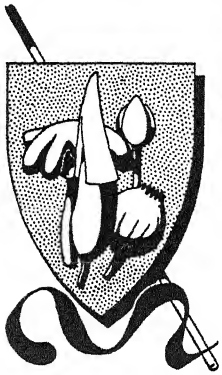

THE BRYOLOGIST

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ERRATA

Page 4, line 4: for CATHARINEA read CATHARINAEA

Page 77, line 24: for ANDREA read ANDREAEA

Page 90, line 16: for DISTRICHIUM read DISTICHIUM

Page 103, line 4: for PLEUROTA read PLEUROCARPA

Page 103, line 7: for SUBASCYPHOSA read SUBSCYPHOSA

THE BRYOLOGIST

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LATER GENERIC HOMONYMS AMONG NORTH AMERICAN MOSSES

ELBERT L. LITTLE, JR.

A comparison of the moss genera of North America north of Mexico recognized in the standard work by Grout (16) with the indexes on nomenclature reveals that eleven generic names of mosses are technically unavailable under the latest rules because they are later homonyms of genera of flowering plants. It is here suggested that ten of these generic names of mosses be formally adopted as *nomina conservanda*, as the earlier homonyms are synonyms long in disuse. No new names are needed, but it seems necessary to adopt a later name for the eleventh genus, which contains only one species. One additional genus should be conserved as emended.

When the International Rules of Botanical Nomenclature (3) were revised at the Fifth International Botanical Congress in Cambridge in 1930, the rule about homonyms was changed (Articles 60 (3) and 61) to reject a later homonym even if the earlier homonym is a synonym and not in use. The American Code of Nomenclature (2), also in use in the United States for some years earlier, had contained a similar provision. However, previous to 1930, the earliest available name was adopted under the International Rules, even if it were a later homonym, provided that the earlier homonym had been rejected as a synonym.

As Rehder and others (26) stated, the homonym rule was changed with the definite understanding that all well-known generic homonyms should, as far as possible, be adopted as *nomina conservanda* under Article 21, in order that the changes in names should be as few as possible. A systematic search for later homonyms among the seed

plants was made by Rehder (26) and others, and their list was submitted to the Sixth International Botanical Congress at Amsterdam in 1935. As a result, additional *nomina conservanda* of seed plants were accepted (29).

Thirty generic names of mosses were listed as *nomina generica conservanda proposita* at Cambridge in 1930 and were published in the International Rules (3, pp. 129–130). The list of *nomina conservanda* of mosses proposed at Amsterdam in 1935 by H. N. Dixon (10; 28, pp. 67–68), on behalf of the Bryological Subcommittee, contained only five genera. Four of these were accepted, and the other was withdrawn because it could be retained without conserving it. Only one of the genera in the 1935 list was proposed because it was a later homonym. Dixon (11) in 1939 published two proposals which had been sent to the members of the Special Committee for Musci appointed in 1935 and which were to have been made at the Stockholm Congress, cancelled because of the war. No additional *nomina generica conservanda* were suggested, though one of the proposals was a list of lectotypes (standard species) for the thirty-three *nomina conservanda* adopted at the Cambridge and Amsterdam Congresses.

While engaged in checking the nomenclature of the forest trees of the United States, I accidentally observed that the familiar names *Bartramia* and *Hedwigia* had been used previously among the flowering plants and thus technically were unavailable for moss genera. An article suggesting that *Bartramia* Hedw. be conserved was then prepared (23). As no systematic search for later homonyms of Musci has been made since the present rules on nomenclature were adopted, this compilation was prepared in the interest of stability of bryological nomenclature for use at the next International Botanical Congress. Edwin B. Bartram and A. J. Grout, the two American members of the Special Committee for Musci appointed by the Amsterdam Congress in 1935, kindly have looked over the manuscript of this article. However, the proposals suggested here are my own and have no official status.

Nearly fifty years ago Le Jolis (21, pp. 305–312; 22) in two articles listed 75 generic and subgeneric names of mosses which previously had been used, or used with slightly different spelling, in other groups of the plant kingdom. However, names with slightly different spellings are permitted under Article 70. Most of the other moss names were synonyms or have been changed because of the earlier homonyms.

Only two of these were recognized by Grout (16) and also technically invalidated by present rules, and thus need to be considered here. They are the subgenera *Girgensohnia* Lindb. and *Heterophyllium* Schimp., both listed by Le Jolis as subgenera, though the latter was elevated to generic rank shortly before Le Jolis's articles were published. Bryologists will agree with Le Jolis's (21, p. 312) statement that before replacing a generic name of mosses, it is necessary to ascertain positively that the change is absolutely unavoidable. His longer article on nomenclature of mosses was reviewed by Mrs. Britton (4).

In this age of specialization, it might be possible to use the same generic names in different groups of plants without confusion, just as identical names for plants and animals are permitted under the International Rules (Article 6). However, there is a slight chance for error. For example, during this compilation a species of moss was found in the Index Kewensis, the monumental work restricted to seed plants. It is: *Campylopus bermudianus* R. S. Williams (N. Y. Bot. Gard. Jour. **13**: 193. 1913; No. Amer. Fl. **15**: 148. 1913), listed under *Campylopus* Spach, a synonym of *Hypericum* L., family Hypericaceae (Index Kew. Sup. **5**: 45. 1921). Fortunately, nearly all the generic names of mosses that are later homonyms of names in other groups of plants can be retained without confusion merely by making them *nomina conservanda.*

In various instances generic names of mosses differ by only one or two letters from names in other groups of plants. Under Article 70, generic names differing only in the termination, and even by one letter only, must be regarded as distinct, unless they are mere orthographic variants of the same name. In this search for homonyms, names differing by one letter have not been considered. To regard these slightly different names as homonyms would cause more confusion in nomenclature. Moreover, as the genera belong to separate divisions of the plant kingdom, the names would not likely be mixed, especially as long as they are spelled correctly. For example, there is no confusion between *Brya* P. Br. (1756; Leguminosae) and the moss genus *Bryum* [Dill., 1718; L., 1753] Hedw. (1801; Bryaceae).

Part of the later homonyms are genera named for persons. If a genus dedicated to a botanist were reduced to synonymy, it formerly was desirable as well as in accord with the rules to name another genus in his honor. In this manner the same name was given to two,

or sometimes three or more, genera. Examples of homonyms among the mosses named for persons, which will be discussed below, are: *Bartramia, Girgensohnia, Hedwigia, Meesia,* and *Timmia.*

Another rule adopted in 1930 invalidates a few names of moss genera. Under Article 20, legitimate botanical nomenclature begins for the Muscineae with Hedwig (19), Species Muscorum Frondosum, in 1801, while nomenclature of most plants, including seed plants, pteridophytes, Sphagnaceae, liverworts, algae, and lichens, starts with Linnaeus, Species Plantarum, in 1753. Under this rule, for example, the moss genus *Barbula* Hedw. (1782) dates only from its publication again as *Barbula* Hedw. in 1801 and thus becomes invalid under Article 61 as a later homonym of *Barbula* Lour. (1790; Verbenaceae). These five well-established generic names of North American mosses lost their priority to homonyms because of the starting point in 1801: *Barbula, Hedwigia, Meesia, Timmia,* and *Tortula.* Obviously these older moss names which have lost their priority on this technicality should be restored as *nomina conservanda.*

Methods used in finding the later homonyms will be noted. The generic names of mosses of North America north of Mexico accepted as valid in Grout's (16) detailed work, which was begun before the rules were revised, and in his condensed list (17) were checked against homonyms in the familiar indexes and nomenclators. For homonyms among the seed plants the two standard indexes were examined: Dalla Torre and Harms (9), Genera Siphonogamarum, and Jackson and others (20), Index Kewensis and Supplementa 1 to 9. The following older works were consulted also: Durand (12), Bentham and Hooker (1), Steudel (30), and Endlicher (13). Pfeiffer (25), Nomenclator Botanicus, covering the plant kingdom, was helpful not only for homonyms but for synonyms, variant spellings, and citations of works up to 1858 adopting the names being checked. Homonyms and synonyms among the mosses were further verified in Paris (24), Index Bryologicus.

In a less thorough search for homonyms of moss genera now in use among other groups of cryptogams, a few additional references were examined. These were: Christensen (7), Index Filicum, covering the ferns (Filicineae and Hydropteridineae); Buch, Evans, and Verdoorn (5), A preliminary check list of the Hepaticae of Europe and America (North of Mexico); Evans (14), List of Hepaticae found in the United States, Canada, and Arctic America; Smith (27), Fresh-water Algae

of the United States; Clements and Shear (8), Genera of Fungi; and Fink and Hedrick (15), Lichen Flora of the United States.

A further check for specific homonyms among the generic homonyms was made in Jackson and others (20), Index Kewensis and Supplementa 1 to 9. Fortunately, there were no cases of double homonyms, where the same specific epithet had been used independently under the same generic name in both groups of plants. However, the generic homonyms in the seed plants contained very few species, and chance duplication of names among small numbers of species would be rare.

MISCELLANEOUS HOMONYMS

A few generic names of mosses previously conserved are later homonyms of genera of flowering plants. The moss genus *Hookeria* Smith (1808, after June) was conserved over the variant spelling *Hookera* Salisb. (March 1, 1808; Liliaceae), though the latter had earlier been rejected also in favor of the conserved genus *Brodiaea* Smith (1810). Similarly, the moss genus *Neckera* Hedw. (1801), which was originally spelled *Neckeria* by Hedwig in 1782, was made a *nomen conservandum* over *Neckeria* Scop. (1777; Papaveraceae). *Corydalis* Medic. (1789) had been conserved before over the latter also. There is also *Neckeria* J. F. Gmel. (1791), synonym of *Pollichia* Ait. (1789; Illecebraceae).

Papillaria (C. Müll.) C. Müll. (Svenska Vetensk. Akad. Öfversight af . . . Forhandl. **1876 (No. 4)**: 34. 1876), based upon *Neckera* sect. *Pseudopilotrichum* subsect. *Papillaria* C. Müll. (Syn. Musc. Frond. **2**: 134, 670. 1851), was proposed as a *nomen conservandum* in 1935 (28, p. 67) because of the earlier homonym, *Papillaria* Dulac (1867), which was a synonym of *Scheuchzeria* L. (1753; Juncaginaceae). Brotherus (6, **11**: 161. 1925) had adopted *Papillaria* (C. Müll.) C. Müll. for the moss genus. However, Grout (16, **3**: 213. 1934) in taking up *Tricholepis* Kindb. (1899) stated that *Papillaria* had been used three times before it was given to this moss genus, and Pfeiffer (Nomencl. Bot. **2**: 585. 1874) had cited two homonyms before 1858. As a *nomen conservandum*, *Papillaria* (C. Müll.) C. Müll. was later adopted by Grout (16, **1**: 252. 1934) under his additions and corrections and in his list of mosses (17, p. 130). *Tricholepis* Kindb., a later synonym for this genus, is untenable because it is a later homonym of the currently recognized genus, *Tricholepis* DC. (1833; Compositae).

Two moss genera conserved against earlier synonyms are automatically conserved over earlier homonyms detected during this check of names (Article 21, Note 4). Thus, *Ditrichum* [Timm, 1788] Hampe (1867), conserved over three earlier synonyms of mosses, is protected also against *Ditrichum* Cass. (1817), a synonym of *Verbesina* L. (1753; Compositae) and against a fourth, earlier synonym, *Leptotrichum* Hampe (1847), which is a later homonym of the fungus genus *Leptotrichum* Corda (1842). *Drummondia* Hook. (1849), *nomen conservandum* over *Leiotheca* Brid. (1826), is also conserved over *Drummondia* DC. (1830), a synonym of *Mitella* L. (1753; Saxifragaceae).

Le Jolis (21, pp. 312–313) listed three generic names then in use for seed plants which he stated should be abandoned because of earlier homonyms in mosses. One of these, *Hedwigia*, which was reported earlier by Harkness (18) in 1885, is still unsettled and is discussed in detail in this article. There is no longer a conflict between *Sporledera* Hampe (1837) and *Sporledera* Bernh. (1842; Pedaliaceae), because the latter is a synonym of *Ceratotheca* Endl. (1832). Besides, Grout (16, 1: 32. 1936) regarded the moss genus as a synonym of *Bruchia* Schwaegr. (1824). The case of *Swartzia*, the third genus, was solved by retaining the name among the flowering plants, though the moss genus would lose priority under the 1801 starting date, anyway. *Swartzia* Schreb. (1791; Leguminosae) was made a *nomen conservandum* over three synonyms as well as over the homonym *Swartzia* [Ehrh. ex Hedw., 1789] Beauv. (1805). Grout (16, 1: 38. 1936) listed *Swartzia* Beauv. as a synonym of *Distichium* Bry. Eur. (1846), also a *nomen conservandum*.

Three more genera of mosses with later homonyms among the seed plants were found. In each case the genus of seed plants contained a single species and was later reduced to synonymy. Thus there is no conflict, and the earlier homonyms among the mosses remain valid. The moss genus *Campylopus* Brid. (1819) has a later homonym, *Campylopus* Spach (1836), which is a synonym of *Hypericum* L. (1753; Guttiferae). *Cryphaea* Mohr (1803) is an earlier homonym of *Cryphaea* Buch.-Ham. (1825), which is a synonym of *Chloranthus* Sw. (1787; Chloranthaceae). *Hypopterygium* Brid. (1827) has a later homonym, *Hypopterygium* Schlecht. (1843), which is a synonym of *Juliana* Schlecht. (1843; Anacardiaceae).

No homonyms of moss genera were found in use among the groups of cryptogams in the few references examined, which do not cover the

synonymy of all these groups completely. Among the ferns one duplicate name, a later homonym of the moss genus *Pleuridium* Brid. (1819), was noted. It is *Pleuridium* (Presl) Fée (1850–52), based upon *Polypodium* sect. *Pleuridium* Presl (1836) and regarded as a synonym of *Polypodium* L. (1753). In two instances identical generic names given later to fungi were discarded because of prior use in mosses. These are: *Andreaea* Palm and Jochems (1923), later changed to *Andreaeana* because of the moss genus *Andreaea* Hedw. (1801); and *Venturiella* Speg. (1909), a later homonym of the moss genus *Venturiella* C. Müll. (1875), corrected to *Neoventuria* Syd. (1919) but regarded by Clements and Shear (8, p. 273) as a synonym of *Lasiosphaeris* Clem. (1909).

NOMINA GENERICA CONSERVANDA PROPOSITA

It is suggested that the eleven generic names of Musci discussed below be considered by the Special Committee for Musci and proposed under Article 21, Note 1, as additions to the *nomina generica conservanda* of Musci at the next International Botanical Congress. If the names are provisionally approved by the Executive Committee, botanists are authorized under Article 22 to retain them pending the decision of the next Congress. Until such time as these genera can be formally presented at an International Botanical Congress, it is hoped that bryologists will continue to use these familiar names and that no unnecessary new names will be published.

The first ten are later homonyms of generic names of seed plants which in turn are later synonyms and, with the exception of *Hedwigia* Sw., probably have not been used for about a hundred years or longer. The synonymy and reasons for conservation are summarized under each genus. No reasons against conservation are known. These generic names of mosses are well established in usage. Seven are more than a hundred years old and the most recent was published in 1905. Numerous early references of works adopting these names up to 1858 were cited by Pfeiffer (25). All ten were accepted both by Brotherus (in Engler and Prantl, Natürl. Pflanzenfam. Aufl. 2, Bd. **10–11.** 1924–25) and by Grout (Moss Fl. No. Amer. 3 v. 1928–40; and THE BRYOLOGIST **43**: 117–131. 1940). Four are type genera of their respective families (Bartramiaceae, Ephemeraceae, Meesiaceae, and Timmiaceae), and a fifth is sometimes placed as the type of a segregate family (Hedwigiaceae). If they are not made *nomina*

conservanda, new names would have to be made for most of them, and hundreds of new combinations would be necessary.

Barbula Hedw. [Fund. Hist. Nat. Musc. **2**: 92. 1782.] Sp. Musc. Frond. 115. 1801. (Musci, Pottiaceae.) Non *Barbula* Lour., Fl. Cochinch. **2**: 366. 1790. Type species: *B. unguiculata* Hedw.

Synonym: *Streblotrichum* Beauv., Prodr. Fam. Aethéog. 27, 89. 1805.

The oldest name, *Barbula* Hedw. (1782), must be ignored because nomenclature of Muscineae begins in 1801 (Article 20). Thus, *Barbula* Lour. (1790; Verbenaceae), in which one species of Asia was described and which has not been used for more than a hundred years, has priority over the moss genus, *Barbula* Hedw. (1801), which has about 300 species of world-wide distribution. *Barbula* Lour. (1790), apparently rejected under old rules because of the earlier *Barbula* Hedw. (1782), thus becomes under Article 20 the valid name for a later synonym, *Caryopteris* Bunge (Pl. Mongol.-Chin. 27. 1835). *Caryopteris* Bunge (Verbenaceae), with about 5 species in Asia, was adopted by: Bentham and Hooker (Gen. Pl. **2**: 1157. 1876), by Briquet (in Engler and Prantl, Natürl. Pflanzenfam. **4** (**3a**): 178. 1897), and by Dalla Torre and Harms (Gen. Siphon. 433. 1904).

Modern authors uniformly accept *Barbula* Hedw. A synonym in part is *Streblotrichum* Beauv., apparently not used in more than a hundred years. Unless *Barbula* Hedw. is made a *nomen conservandum*, two generic names in use more than a hundred years would have to be rejected, *Barbula* Lour. would have to be restored, and another name with many new combinations taken up for the moss genus, *Barbula* Hedw.

Bartramia Hedw. [Descr. Musc. Frond. **2**: 111, *pl. 40.* 1789.] Sp. Musc. Frond. 164. 1801. (Musci, Bartramiaceae.) Non *Bartramia* L., Sp. Pl. 389. 1753, et Gen. Pl. Ed. 5, 184. 1754; nec *Bartramia* Salisb., Prodr. Stirp. Chap. Allert. 99. 1796; nec *Bartramia* Collinson ex J. E. Smith, Select. Corresp. Linn. **1**: 16. 1821; nec *Bartramia* W. Bartram ex F. Harper, Bartonia **21**: 7. 1942. Type species: *B. Halleriana* Hedw.

Synonym: *Cephaloxis* Beauv., Prodr. Fam. Aethéog. 30, 52. 1805.

I have previously suggested that this genus be made a *nomen conservandum* (THE BRYOLOGIST **44**: 107–110. 1941) and shall summarize the nomenclature here with some additional data. *Bartramia* Hedw., of world-wide distribution with about 110 species, is the type of the family Bartramiaceae and is in universal usage.

Bartramia L., published as a genus in 1747 [L., Fl. Zeyl., Nov. Gen. Pl. Zeyl. 9], was reduced to a synonym of *Triumfetta* L. (Sp. Pl. 444. 1753; Gen. Pl. Ed. 5, 203. 1754; Tiliaceae) by Linnaeus himself (Syst. Nat. Ed. 10, 1044. 1759) in accordance with Article 56. Linnaeus had only one species in *Bartramia* L., but Gaertner (Fruct. Sem. Pl. **2**: 137, *pl. 11, fig. 5.* 1791) revived the genus and named one species. This name has not been used for about one hundred years, except as a section, *Triumfetta* sect. *Bartramea* DC. (1824).

The homonym *Bartramia* Salisb. technically has priority also over *Bartramia* Hedw. under Article 20, establishing the beginning date for nomenclature in Muscineae as 1801. Salisbury's genus of two species, which apparently was not adopted by other authors, is a later homonym and also a synonym of *Penstemon* Schmidel (1762; Scrophulariaceae).

Bartramia Collinson ex J. E. Smith was a manuscript name suggested to Linnaeus in a letter from Peter Collinson dated Aug. 5, 1746, before Linnaeus gave the name to a genus of India the next year, and was published long afterwards with the correspondence in 1821. It is a synonym of *Dodecatheon* L. (1753; Primulaceae) and is also invalid under Article 37 ter as a *nomen provisorium.*

Another manuscript name was found in notes sent by William Bartram in 1788 to 'Friend Barclay' in London. Published in 1942 in a quotation as *Bartramia* W. Bartram ex F. Harper, the name was not intended for use and is invalid both as a *nomen nudum* and as a *nomen provisorium.* It is a synonym of *Pinckneya* Michx. (1803; Rubiaceae).

Besides the genera segregated from *Bartramia* Hedw., there is a direct synonym, *Cephaloxis* Beauv., in which no binomials have been made and which apparently was adopted by no other authors after its publication in 1805. Palisot de Beauvois, in proposing *Cephaloxis* for *Bartramia, Amblyodum* for *Meesia,* and three other generic substitutions, stated that names of men given to genera should be replaced by descriptive names. Under present rules (Articles 61, 69), *Cephaloxis* Beauv. could be adopted as the proper generic name. Unless *Bartramia* Hedw. is conserved, all the species would have to be transferred to *Cephaloxis.* As the other homonyms long ago passed into disuse, obviously the proper procedure is to make *Bartramia* Hedw. a *nomen conservandum.* The segregate genus *Bartramidula* Bryol. Eur. (1846) previously was conserved.

Ephemerum Hampe, Flora **20**: 285. 1837. (Musci, Ephemeraceae.)

Non *Ephemeron* Mill. et *Ephemerum* [Tourn.] Mill., Gard. Dict. Abridged Ed. 4, v. 1. 1754 (*Ephemerum* Moench, Meth. Pl. 237. 1794); nec *Ephemerum* Reichb., Fl. Germ. Excurs. 409. 1831. Type species: *E. serratum* (Hedw.) Hampe.

Synonym: None?

Ephemerum Hampe (1837) with about 30 species is the type genus of the family Ephemeraceae. The pre-Linnaean genus *Ephemerum* Tourn. (1700) was published by Miller (1754) in a work without binomial nomenclature and thus without specific names. This genus is a synonym of *Tradescantia* L. (1753; Commelinaceae) and has not been used for nearly one hundred fifty years, though Moench (Meth. Pl. 237. 1794) published 4 species in *Ephemerum*. *Ephemerum* Reichb. (1831), with 2 species, was previously used as *Lysimachia* sect. *Ephemerum* Reichb. (Consp. Regn. Veget. 127. 1828), a *nomen nudum*. It is a synonym of *Lysimachia* L. (1753; Primulaceae) and has not been used in nearly a hundred years. Apparently there are no direct synonyms for the moss genus *Ephemerum* Hampe, which is in universal use. The segregate *Ephemerella* C. Müll. (Syn. Musc. Frond. **1**: 34. 1849) has already been made a *nomen conservandum* over *Physedium* Brid. (1826).

Hedwigia [Ehrh., Hann. Mag. **1781**: 1095. 1781.] Beauv., Prodr. Fam. Aethéog. 15. 1805. (Musci, Grimmiaceae.) Non *Hedwigia* Sw., Nov. Gen. Sp. Prodr. Veg. Ind. Occ. 4, 62. 1788; nec *Hedwigia* Medic., Acta Acad. Theod.—Palat. **6. Phys.**: 495. 1790. Type species: *H. ciliata* (Hedw.) Beauv.

Synonym: None?

This complicated case is similar to that of *Barbula* Hedw. The moss genus *Hedwigia* Ehrh. (1781) cannot be recognized because of Article 20. In the work with which nomenclature of Muscineae begins, the name was reduced to a synonym of *Anictangium* Hedw. (Sp. Musc. Frond. 40. 1801), which has been made a *nomen rejiciendum* in place of the *nomen conservandum Anoectangium* Schwaegr. (Sup. **1** (**1**): 33. 1811; emend. Bry. Eur. 1846; Pottiaceae). Apparently the moss genus dates from *Hedwigia* Beauv. (1805), and Palisot de Beauvois should be cited as the author. This genus is without generic synonyms and has one cosmopolitan species, *Hedwigia ciliata* (Hedw.) Beauv. (Prodr. Fam. Aethéog. 15. 1805). Some authors, such as Brotherus (in Engler and Prantl, Natürl. Pflanzenfam. Aufl. 2, **11**: 66. 1924), recognize the family Hedwigiaceae, with this genus as the type.

The homonyms *Hedwigia* Sw. and *Hedwigia* Medic. both have

technical priority over the moss genus *Hedwigia*, which under Article 20 must date from 1805, not 1781. *Hedwigia* Medic. (1790), with a single species and not used for about one hundred fifty years, is invalid both as a later homonym and as a later synonym of *Commelina* L. (1753; Commelinaceae).

Hedwigia Sw. (1788; Burseraceae) was recognized as a genus by Bentham and Hooker (Gen. Pl. **1**: 326. 1862–67) and by Jackson (Index Kewensis **1**: 1099. 1895) but has generally been abandoned because of the earlier moss genus which formerly had priority. Instead, the next of four later synonyms, *Tetragastris* Gaertn. (Fruct. Sem. Pl. **2**: 130, *pl. 109, fig. 5.* 1791), is in general use for the genus of Burseraceae with about 3 species in the American tropics. It was accepted by: Engler (in Engler and Prantl, Natürl. Pflanzenfam. **3** (**4**): 238. 1897), by Dalla Torre and Harms (Gen. Siphon. 258. 1901), and by Rose (No. Amer. Fl. **25**: 257. 1911).

Though only a few species (and possibly a family name) are involved, it seems better to adopt *Hedwigia* Beauv. as a *nomen conservandum* than to create a new generic name for the monotypic moss genus. If *Hedwigia* Beauv. is not conserved, then *Hedwigia* Sw. must replace *Tetragastris* Gaertn. in the flowering plants.

Helodium (Sull.) Warnst., Krypt. Fl. Mark Brand. **2**: 675, 692. 1905. (Musci, Leskeaceae.) Non *Helodium* Dumort., Fl. Belg. 77. 1827. Type species: *H. Blandowii* (Web. and Mohr) Warnst.
Synonym: None?

Helodium (Sull.) Warnst. was based upon *Hypnum* sect. *Elodium* Sull. (Musc. Hepat. U. S. 68. 1856) and *Thuidium* [sect. or subg.] *Elodium* (Sull.) Lindb. (Musc. Scand. 31. 1879; "*Thyidium*"). There is also the name *Hypnum* subg. *Elodium* Lesq. and James (Man. Mosses No. Amer. 317, 329. 1884). This genus of about 5 species of broad range apparently has no synonyms. The earlier homonym, *Helodium* Dumort., with only 3 species, is a synonym of *Apium* L. (1753; Umbelliferae) and has not been used for more than a hundred years.

The binomial "*Elodium paludosum*" was published as early as 1870 by Austin (Musci Appal. 52, 80. 1870) in an irregular manner with the following brief citation and description: "*Sulliv. Icon. Musc. p.* 157, *t.* 101. Foliis saepe papillosis: an Thuidii species?" There is no indication that a new genus was intended, but under the Paris Code of 1867 priority began with subgeneric names. As the title stated,

this book was just a printed copy of the labels of Austin's specimens of mosses, together with an index. Incidentally, the name *Elodium* did not appear in work of Schimper cited by Austin. There is some question whether this improperly published name should be accepted under Articles 19, 36, 37, 42, and 43 as a new monotypic genus with a species transfer. Grout (Moss Fl. No. Amer. **3**: 180. 1934) adopted Austin's specific combination *Helodium paludosum* (Sull.) Aust. (Musc. Appal. 306. 1870) but on the preceding page cited the genus *Helodium* (Sull.) Warnst. (Laubm. Krypt. Fl. Mark Brand. 692. 1905). If the genus was not considered as validly published until 1905, obviously a legitimate specific combination could not be made in the genus thirty-five years earlier (Articles 45 and 60). Especially as no change in epithets is involved but merely changes in authors and citations, it seems better to regard *Elodium paludosum* Austin as illegitimate both as a new genus and as a new specific combination. It is not desirable to conserve an irregularly published name when the same epithet can be retained by conserving it in a later citation.

When conserved as *Helodium* (Sull.) Warnst., the original generic spelling *Helodium* rather than *Elodium*, should be adopted under Article 70, Note 1, and Recommendation XXXVIII. Brotherus (in Engler and Prantl, Natürl. Pflanzenfam. Aufl. 2, **11**: 328. 1925) and Grout (Moss Fl. No. Amer. **3**: 179. 1934) followed Warnstorf's spelling, and the former had this genus as the type of the subfamily Helodioideae of the family Thuidiaceae. Both Warnstorf and Grout called attention to the preferred spelling *Helodium* for this name of Greek derivation (Recommendation XXXVIII).

Heterophyllon Kindb., Eur. No. Amer. Bryin., Genera, 23. 1897; Eur. No. Amer. Bryin., Species, 122. 1896. (Musci, Hypnaceae.) Non *Heterophyllum* Boj. ex Hook., Bot. Misc. **1**: 291. 1830; *pro synon.* Type species: *H. nemorosum* (Koch) Kindb.

Synonym: None?

The moss genus *Heterophyllon*, with orthographic variants *Heterophyllum* and *Heterophyllium*, presents some complications in nomenclature. Though it is accepted as a genus of wide distribution with about 13 species, Grout (Moss Fl. No. Amer. **3**: 137. 1932) thought "that it would better remain as a subgenus of *Hypnum*." While the name may be in correct usage without being conserved, questions of spelling, place of publication, and an apparent earlier homonym can be settled easily by adopting the name as a *nomen conservandum* along with the others.

The name was published first as a subgenus with two species, *Hypnum* subg. *Heterophyllium* (Syn. Musc. Eur. 629. 1860). Kindberg (Canad. Rec. Sci. **6**: 72. 1894) in a bare list of names had the genus "*Heterophyllum* (Schimp.), C. M." with one species, "*nemorosum* (Koch), Kindb." It is doubtful whether this name was adequately published as a new genus under Articles 37 and 42. As C. Müller was cited as author, a new name may not have been intended. However, if necessary to avoid changes in nomenclature, the name might be accepted. Paris (Index Bryol. Ed. 2, **2**: 312. 1904) listed also "*Heterophyllum* C. M. in Dusen M. Camer." as a synonym of *Rhapidostegium* (Bry. Eur.) De Not. Apparently this genus of C. Müller was an unpublished herbarium name on specimens of mosses from Cameroon, Africa.

Shortly afterwards Kindberg published but without reference to the earlier subgenus or his transfer the following as a new genus with a third variant spelling: *Heterophyllon* Kindb., Eur. No. Amer. Bryin., Genera, 23. 1897 (with brief description); Eur. No. Amer. Bryin., Species, 122. 1896 (with 5 species and specific descriptions). If the combination *Heterophyllum* (Schimp.) Kindb. (1894) was improperly made, then the new genus was published independently as *Heterophyllon* Kindb. (1896).

Brotherus (in Engler and Prantl, Natürl. Pflanzenfam. Aufl. 2, **11**: 409, 411. 1925) adopted the moss genus with the spelling *Heterophyllium* as the type of the subfamily Heterophylloideae of the family Sematophyllaceae. Grout (Moss Fl. No. Amer. **3**: 137. 1932) had *Heterophyllum* but changed to the spelling *Heterophyllium* in the appendix (Grout, Moss Fl. No. Amer. **2**: 272. 1940) and in his later list (THE BRYOLOGIST **43**: 127. 1940). The spelling to be retained apparently is *Heterophyllon* (Article 70 and Notes 1 and 4), though a different spelling might be conserved.

Le Jolis (Cherbourg Soc. Natl. Sci. Nat. Math. Mém. **29**: 311. 1895; Rev. Bryologique **22**: 22. 1895) called attention to the earlier name *Heterophyllum* Boj., which would be an orthographic variant of *Heterophyllon*, rather than a distinct name (Article 70 and Notes 3 and 4). *Heterophyllum* Boj., with a single species, was a manuscript name published in synonymy by Hooker and as a synonym had no status under Article 40. Bojer's manuscript name *Heterophyllum ramosum* was listed as a synonym when Hooker published the same species under the name *Byttneria heterophylla* on the same page (Hook.,

Bot. Misc. **1**: 291, *pl. 61.* 1830). However, *Heterophyllum* Boj. appears in indexes and may have been validly published later and is a source of uncertainty as a possible earlier homonym. It is a synonym of *Byttneria* Loefl. (1758; Sterculiaceae) and probably has not been used for about a hundred years. *Byttneria* Loefl., usually spelled *Buettneria*, is a *nomen conservandum.*

Because of the earlier *Heterophyllum* Boj., which may never have been properly published, it seems best to conserve *Heterophyllon* Kindb. However, it may not be absolutely necessary to conserve this genus in order to continue to use it correctly. If combined with *Hypnum* Hedw. (1801) emend., also a *nomen conservandum*, the latter, and older, name would be used under Article 21, Note 3, and Article 56.

Incidentally, the name *Heterophyllum* was published again in 1897 for a subgenus of flowering plants, *Oxalis* L. subg. *Heterophyllum* Reiche (in Engler and Prantl, Natürl. Pflanzenfam. **3** (**4**): 351. 1897; family Oxalidaceae). While it is permissible under the rules to take as a subgenus the name of a genus or subgenus of another genus, this practice is contrary to Recommendation XI (c).

Meesia Hedw. [Fund. Hist. Nat. Musc. **2**: 97, *pl. 9, figs. 56, 57.* 1782.] Sp. Musc. Frond. 173. 1801. (Musci, Meesiaceae.) Non *Meesia* Gaertn., Fruct. Sem. Pl. **1**: 344, *pl. 70, fig. 6.* 1788. Type species: *M. longiseta* Hedw.

Synonyms: *Diplocomium* Weber and Mohr, Naturhist. Reise Schwed. 177. 1804; Taschenb. 374, *pl. 9, fig. 5.* 1807. *Amblyodum* Beauv., Prodr. Fam. Aetheóg. 30, 33. 1805.

Meesia Hedw., of very wide range and containing about 10 species, is the type of the family Meesiaceae. Though first published in 1782, the moss genus must date from 1801 under Article 20 and thus becomes a later homonym. The monotypic genus *Meesia* Gaertn. has not been used in more than a hundred years and is a synonym of *Ouratea* Aubl. (1775; Ochnaceae), which is a *nomen conservandum.* Though *Meesia* Gaertn. is not listed among the *nomina rejicienda* (Internatl. Rules. Ed. 3, 103. 1935), it is unavailable for use under Article 21, Note 3.

As *Meesia* Gaertn. is rejected, there can be no confusion in retaining the name *Meesia* Hedw. for the moss genus. The synonym, *Diplocomium* Weber and Mohr, was published in 1804 for the type species of *Meesia, Meesia longiseta* Hedw., and in 1807 these authors transferred this species and another to *Diplocomium.* If *Diplocomium* were adopted, new combinations for nearly all the species would be necessary. *Amblyodum* Beauv., another synonym, is now used in an

emended sense for a closely related genus and should be conserved as emended. Though the genus was dedicated to the Dutch gardener, David Meese, and is sometimes spelled *Meesea*, the original spelling *Meesia* should be accepted under Article 70. After Hedwig, the spelling *Meesea* was adopted by C. Müller (Syn. Musc. Frond. **1**: 464. 1848) and others. Brotherus (in Engler and Prantl, Natürl. Pflanzenfam. Aufl. 2, **10**: 444. 1924) used the spelling *Meesea*, while Grout (Moss Fl. No. Amer. **2**: 181. 1935) adopted *Meesia* as Hedwig's original spelling.

Myrinia Schimp., Syn. Musc. Eur. 482. 1860. (Musci, Fabroniaceae.) Non *Myrinia* Lilja, Fl. Öfv. Sverig. Odl. Vexter. Första Sup. 25. 1840. Type species: *M. pulvinata* (Wahlenb.) Schimp.

Synonym: None?

It seems simpler and less confusing to make this genus of two species from far northern latitudes a *nomen conservandum* than to establish a new name for it. The genus is in universal usage and was recognized by Brotherus (in Engler and Prantl, Natürl. Pflanzenfam. Aufl. 2, **11**: 294. 1925) as the type of the subfamily Myrinioideae of the family Fabroniaceae. The earlier homonym, *Myrinia* Lilja, which is a synonym of *Fuchsia* L. (1753; Onagraceae), contained only a single species and apparently has not been used for about a hundred years. In fact, Lilja (Linnaea **15**: 262. 1841), the author, reduced his own genus *Myrinia* Lilja to a synonym of *Encliandra* Zucc. (1837) in 1841, only a year after he published it.

Timmia Hedw. [Descr. Musc. Frond. **1**: 83, *pl. 31*. 1787.] Sp. Musc. Frond. 176. 1801. (Musci, Timmiaceae.) Non *Timmia* J. F. Gmel., Syst. Nat. Ed. 13, **2**: 524, 538. 1791. Type species: *T. megapolitana* Hedw.

Synonym: None?

This widely distributed moss genus of about 8 species is the type of the family Timmiaceae, and its name is universally accepted. The name *Timmia* was first applied, but before 1801, to the moss genus, which loses priority under Article 20. The homonym *Timmia* J. F. Gmel. contained only about 2 species and has not been in use for nearly one hundred fifty years. It is a synonym of *Cyrtanthus* Ait. (1789; Amaryllidaceae). A synonym possibly available for the moss genus is the manuscript name *Omphalophora* Brid., which was listed as a synonym of *Timmia* Hedw. by Endlicher (Gen. Pl. 54. 1836) and by Pfeiffer (Nomencl. Bot. **2**: 495, 1419. 1874) but which may never have been validly published.

Tortula Hedw. [Fund. Hist. Nat. Musc. **2**: 92, *pl. 8, fig. 38, 39.* 1782.] Sp. Musc. Frond. 122. 1801. (Musci; Pottiaceae.) Non *Tortula* Roxb. ex Willd., Sp. Pl. Ed. 4, **3**: 359. (1800?) 1801; nec *Tortula* Ritgen in Schr. Marb. Ges. **2**: 91. 1831. Type species: *T. subulata* Hedw.

Synonym: None?

Tortula Hedw., a large, world-wide genus of about 230 species or less, dates from 1801, not 1782, under Article 20 and may lose its priority to *Tortula* Roxb. ex Willd., if the latter name was published earlier. If the date on the title page of Willdenow (Sp. Pl. Ed. 4, v. 3) is correct, *Tortula* Roxb. ex Willd. appeared in 1800 and would have priority. However, according to the example given under the International Rules (Article 45, Examples), volume 3, part 1, containing this name was published in 1801 also. *Tortula* Roxb. ex Willd. contained a single species, is a synonym of *Priva* Adans. (1763; Verbenaceae), and apparently has not been in use for more than a hundred years. As it is not known which name was published first in 1801, it seems safest to conserve *Tortula* Hedw. for the large genus of mosses, though the name might have priority anyway. If desired, the genus could be conserved as emended by a later author. While various names of segregate genera are available, apparently there are no equivalent synonyms. The citation of the later name *Tortula* Ritgen (1831), listed by Pfeiffer (Nomencl. Bot. **2**: 1431. 1874) for a genus of fungi, has not been examined.

The following additional genus is not a later homonym but should be proposed as a *nomen conservandum* in its present emended usage and spelling.

Amblyodon Bry. Eur., Fasc. 10. 1841. (Musci, Meesiaceae.) Type species: *A. dealbatus* (Hedw.) Bry. Eur.

Synonym: *Amblyodum* Beauv., Prodr. Fam. Aethéog. 30, 33. 1805; *ex parte.*

The genus *Amblyodum* Beauv., usually spelled *Amblyodon*, was published as a substitute and equivalent name for *Meesia* Hedw., to which Palisot de Beauvois objected because it was named for a person. *Meesia* Hedw. (Sp. Musc. Frond. 173. 1801) originally had 3 species, while *Amblyodum* Beauv. was published with 5 species (p. 41), including the type of *Meesia* Hedw. Unless *Meesia* Hedw. is conserved, as proposed here, the synonym *Amblyodum* Beauv. should be adopted instead of *Meesia* Hedw. If *Meesia* Hedw. is conserved, then *Amblyodum* Beauv. becomes a *nomen rejiciendum* and unavailable for use.

Amblyodum Beauv. was changed to *Amblyodon* Bry. Eur. and emended as a monotypic genus with *A. dealbatus* (Hedw.) Bry. Eur. as the type. The genus is in general use with the changed spelling and description as distinct from *Meesia*. The two slightly different names probably should be treated as orthographic variants under Article 70, Notes 3 and 4, rather than as distinct names. If not an orthographic variant, perhaps *Amblyodon* Bry. Eur. would stand as a valid name without conservation. To retain the present usage it is desirable that *Amblyodon* Bry. Eur. or *Amblyodum* Beauv. emend. Bry. Eur. be made a *nomen conservandum*. Otherwise, a new name would be needed for this monotypic genus.

PLEUROZIOPSIS Kindb. (GIRGENSOHNIA (Lindb.) Kindb.)

Pleuroziopsis Kindb. should replace *Girgensohnia* (Lindb.) Kindb., which was used by Grout (Moss Fl. No. Amer. **3**: 6. 1928) for the monotypic moss genus of the family Hypnaceae, because the latter name is established in use for an older genus of Chenopodiaceae. *Girgensohnia* Bunge (Lehm. Rel. Bot. 302, in Acad. Impér. Sci. St. Pétersb. Mém. **7**: 478. 1851; Bunge ex Fenzl in Ledeb., Fl. Ross. **3**: 835. 1851?; Chenopodiaceae) of Asia contains about 5 species and was adopted by Bentham and Hooker (Gen. Pl. **3**: 72. 1880), by Volkens (in Engler and Prantl, Natürl. Pflanzenfam. **3** (**1a**): 85. 1892), by Jackson (Index Kewensis **1**: 1029. 1895), and by Dalla Torre and Harms (Gen. Siphon. 145. 1900).

The monotypic moss genus *Girgensohnia* (Lindb.) Kindb. (Eur. No. Amer. Bryin. (Part 1) 43. 1896; Gen. Eur. No. Amer. Bryin. 19. 1897) was published as a new combination based upon *Climacium* subg. *Girgensohnia* Lindb. (Contrib. Fl. Crypt. As. Bor.-Or., Act. Soc. Sci. Fenn. **10**: 249. 1872). Even before the name had been elevated to generic rank, Le Jolis (Cherbourg Soc. Natl. Sci. Nat. Math. Mém. **29**: 311. 1895; Rev. Bryologique **22**: 22. 1895) called attention to the earlier use of the name for a genus of Chenopodiaceae.

The available name for the moss genus is *Pleuroziopsis* Kindb. As originally published before *Girgensohnia* Lindb. was raised to a genus, *Pleuroziopsis* Kindb. (Canad. Rec. Sci. **6**: 19. 1894) was invalid as a *nomen nudum* under Articles 41 and 42, consisting of the name as a new genus without description but with 4 included species mentioned. Unless it was adopted with a description by another author in the meantime, the generic name *Pleuroziopsis* Kindb. was validated by

Mrs. Elizabeth G. Britton (THE BRYOLOGIST **9**: 39. 1906) in her notes on the nomenclature of Brotherus. She objected to the adoption of *Girgensohnia* (Lindb.) Kindb. by Brotherus (in Engler and Prantl, Natürl. Pflanzenfam. **1** (**3**): 735. 1905) as an instance where a subgeneric name had been counted in determining priority, though *Pleuroziopsis* had been used as the generic name before *Girgensohnia*. This practice of giving the oldest subgeneric name priority over a later generic name under the Paris Code of 1867 was still permitted at that time, though it is contrary to a rule advocated by Mrs. Britton and later adopted (Article 16). Actually, both *Pleuroziopsis* Kindb. (1894) and *Girgensohnia* (Lindb.) Kindb. (1896) were invalid under present rules, and the moss genus was without a name until Mrs. Britton properly published *Pleuroziopsis* Kindb. ex E. G. Britton (1906), which stands as a new name under Articles 69 and 37. Any other new name not a homonym would have been satisfactory. The combination for the type species and single species now included, *Pleuroziopsis ruthenica* (Weinm.) Kindb. ex E. G. Britton, was published on the same page also (as "*ruthenicum*").

Brotherus (in Engler and Prantl, Natürl. Pflanzenfam. **1** (**3**): 1213. 1909) gave no explanation when he changed to the use of *Pleuroziopsis* as the generic name in the supplement of his monograph. In the second edition, Brotherus (in Engler and Prantl, Natürl. Pflanzenfam. Aufl. 2, **11**: 65. 1925) continued to use *Pleuroziopsis*. There should be no confusion in adopting for this monotypic genus the names *Pleuroziopsis* Kindb. ex E. G. Britton and *Pleuroziopsis ruthenica* (Weinm.) Kindb. ex E. G. Britton in place of *Girgensohnia* (Lindb.) Kindb. and *Girgensohnia ruthenica* (Weinm.) Kindb., as used by Grout (Moss Fl. No. Amer. **3**: 6. 1928; and THE BRYOLOGIST **43**: 127. 1940).

POHLIA Hedw. (WEBERA Hedw.)

Grout (Moss Fl. No. Amer. **2**: 266. 1940) in using the name *Pohlia* Hedw. noted that many Europeans prefer *Webera* Hedw. for this genus of Bryaceae. For example, Brotherus (in Engler and Prantl, Natürl. Pflanzenfam. Aufl. 2, **10**: 357. 1924) adopted *Webera* Hedw. Though names applied to mosses before 1801 cannot be considered under Article 20, *Webera* Ehrh. (Hann. Mag. **1779**: 257. 1779), now usually known as *Diphyscium* Mohr (1803), appeared three years before *Webera* Hedw. (Fund. Hist. Nat. Musc. **2**: 95. 1782),

which in turn was five years before *Pohlia* Hedw. (Descr. Musc. Frond. **1**: 96, *pl. 36*. 1787).

Pohlia Hedw. (Sp. Musc. Frond. 171. 1801) and *Webera* Hedw. (Sp. M usc. Frond. 168. 1801) were published simultaneously in the same work. By Article 56, the author who first unites two names of the same date and adopts one, would be followed. However, in this case *Webera* Hedw. (Sp. Musc. Frond. 168. 1801) was a later homonym of two genera of flowering plants, *Webera* J. G. Gmel. (Syst. Nat. Ed. 13, **2**: 820. 1791), synonym of *Bellucia* Neck. (1790; Melastomaceae), and *Webera* Schreb. (Gen. Pl. **2**: 794. 1791), synonym of *Tarenna* Gaertn. (1788; Rubiaceae). Thus the name *Webera* is not available as a genus of mosses, either for *Pohlia* Hedw. or *Diphyscium* Mohr., unless conserved. Because of the confusion, it seems simpler to abandon the name *Webera* as a generic name of mosses than to propose that it be made a *nomen conservandum* for either genus. Thus *Pohlia* Hedw. (Sp. Musc. Frond. 171. 1801) remains the approved name for this genus.

WEISSIA Hedw.

The name *Weissia*, dedicated to Dr. F. G. Weis (or Weiss), of Gotting, has been applied to two different genera of mosses and spelled in four ways. In moss nomenclature the name dates under Article 20 from *Weissia* Hedw. (Sp. Musc. Frond. 64. 1801) for a genus of Pottiaceae, rather than from *Veisia* Hedw. (Fund. Hist. Nat. Musc. **2**: 90. 1782; spelled *Weisia* in the key on page 83) for the same genus, or from the earlier *Weissia* Ehrh. (Hann. Mag. **1779**: 1003. 1779), now known usually as *Ulota* Mohr (1819). Hedwig used the spelling *Weisia* (Descr. Musc. Frond. v. 1 and 2. 1787) but in later volumes of the same work adopted his third orthographic variant, *Weissia* (v. 3. 1792; v. 4. 1797). A fourth spelling *Weissa* by Schrank was reported by Pfeiffer (Nomencl. Bot. **2**: 1610. 1874). Endlicher (Gen. Pl. 50. 1836) used the spelling *Weissia* Hedw.

The general spelling now is *Weisia*. Grout (Moss Fl. No. Amer. **1**: 153. 1938), in using the spelling *Weisia* in preference to the original form, noted that the botanist for whom the genus was named spelled his name Weis or Weiss and that this spelling avoids confusion with *Weissia* Ehrh. However, *Weissia* Ehrh. is invalid under Article 20, and Hedwig's original spelling in 1801, *Weissia* Hedw. (Sp. Musc. Frond. 64. 1801), should be retained under Article 70.

SUMMARY

1. Eleven generic names of mosses of North America north of Mexico are technically unavailable under the International Rules of Botanical Nomenclature, as revised in 1930. They are invalid as later homonyms under Article 61 or lose their priority to other homonyms under Article 20, which establishes the beginning date of nomenclature of Muscineae as 1801.

2. It is suggested that ten of these names, which are later homonyms of generic names of seed plants long abandoned as synonyms, be proposed under Article 21, Note 1, as *nomina generica conservanda* of Musci. They are: *Barbula* Hedw., *Bartramia* Hedw., *Ephemerum* Hampe, *Hedwigia* Beauv., *Helodium* (Sull.) Warnst., *Heterophyllon* Kindb., *Meesia* Hedw., *Myrinia* Schimp., *Timmia* Hedw., and *Tortula* Hedw. The nomenclature, synonymy, and reasons for conservation are discussed for each genus.

3. The eleventh name, *Girgensohnia* (Lindb.) Kindb., should be rejected because the earlier homonym, *Girgensohnia* Bunge, is the accepted name for an older genus of Chenopodiaceae. *Pleuroziopsis* Kindb. ex E. G. Britton, already in use, should be adopted for the moss genus, which contains only one species.

4. One additional generic name, *Amblyodon* Bry. Eur., should be proposed as a *nomen conservandum* in its present emended usage and spelling.

5. *Pohlia* Hedw. is the proper name for the genus of Bryaceae also known as *Webera* Hedw., not Ehrh. *Webera* Hedw. becomes a later homonym unavailable as a genus of mosses unless conserved.

6. The proper spelling of the genus usually spelled *Weisia* is *Weissia* Hedw. This generic name of the family Pottiaceae has priority over *Weissia* Ehrh., a synonym of *Ulota* Mohr.

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ADDITIONAL MOSSES FROM MOUNTAIN LAKE, VIRGINIA

PAUL M. PATTERSON

The first list of mosses from the Mountain Lake area, Giles County, Virginia, was reported by the writer in 1940.[1] Since then, seven species of *Sphagnum* and sixteen species or varieties of the *Bryales* unreported for this area have been found.

Indebtedness is gratefully acknowledged to Doctors A. LeRoy Andrews, A. J. Grout, A. J. Sharp and W. C. Steere for the identification of many of the collections listed below.

Of the species of *Sphagnum*, *S. palustre* is very commonly distributed over the area. None of the other species is rare with the possible exception of *S. Girgensohnii* and *S. fuscum* where no distributional data exists. Probably none of the *Bryales* listed here, on the other hand, is frequent in the area except *Anomodon viticulosus* and *Barbula unguiculata*. It is surprising to find that *Dicranum undulatum* is rare here. Of particular interest is the occurrence of *Fabronia ciliaris* and *Tortula fragilis*.

The synonymy used is that of A. LeRoy Andrews[2] for *Sphagnum* and A. J. Grout[3] for the *Bryales*. The individual collections, except where otherwise specifically indicated, were made by the writer. The list of additions, making a total of 167 species and varieties reported for the area, is as follows:

SPHAGNALES

Sphagnum palustre L. Common in bogs, springy places and along creeks.

Sphagnum imbricatum Kornsch. Bog near Kire, July 1, 1941. White Pine Lodge, near the Biological Station, July 14, 1934. Little Meadows, Aug. 8, 1941.

Sphagnum recurvum Beauv. Little Meadows, July 24, 1934. Near Kire, July 1, 1941. Cranberry bog, White Pine Lodge, July 12, 1941. Bog at Twin Springs, Biological Laboratory, Aug, 15, 1942 (Coll. by Mr. Lloyd Carr).

Sphagnum subsecundum Nees. Pacer's Gap, Mountain Lake, June 28, 1941. Little Stony Creek at Little Meadows, June 30, 1941. Woods, Little Meadows, June 30, 1941. Little Stony Creek at site of Boy Scout Camp, June 30, 1941. Cascades of Little Stony Creek, July 18, 1941 (Coll. by Mr. Carroll Wood).

[1] THE BRYOLOGIST 43: 159–166. 1940.
[2] North American Flora 15: 1–31. 1913.
[3] Moss Flora of North America North of Mexico. 1928–1940. Newfane, Vt.

Sphagnum Girgensohnii Russow. Wet cliffs at Cascades of Little Stony Creek, July 19, 1941. (Coll. by Mr. Carroll Wood.)

Sphagnum capillaceum tenellum (Schimp.) Andrews. Spring between Biological Station and Bear Cliff, June 24, 1937. Bog near Kire, July 1, 1941. West Virginia Road near Biological Laboratory, July 18, 1941. (Coll. by Mr. Carroll Wood.) Bog near Twin Springs, Biological Laboratory, Aug. 15, 1941. (Coll. by Mr. Lloyd Carr.)

Sphagnum fuscum (Schimp.) H. Klinggr. Cranberry Bog, Little Meadows, July 12, 1941.

BRYALES

Dicranaceae

Dicranum undulatum Ehrh. Woods, Little Meadows, Aug. 8, 1941.

Pottiaceae

Tortula fragilis Taylor. Limestone rock at Sinking Creek, southern side of Salt Pond Mt., Aug. 25, 1941.

Barbula unguiculata Hedw. Frequent on limestone rocks in fields, New River valley.

Funariaceae

Aphanorhegma serratum Sull. Soil, old field, Millbrook, Aug. 25, 1941.

Funaria hygrometrica f. *longinervis* Grout. Soil, Biological Station, July 23, 1942, collected by Miss L. B. Henderson.

Mniaceae

Mnium marginatum (Dicks.) Pal de Beauv. Wet ledges, Cascades of Little Stony Creek, Aug. 15, 1941.

Hypnaceae

Eurhynchium strigosum (Hoffm.) B. & S. On boulder, woods, Doe Creek valley, Aug. 28, 1941.

Brachythecium acutum (Mitt.) Sulliv. Wet soil at lake, Mountain Lake, July 12, 1940.

Leptodictyum riparium (Hedw.) Warnst. In lake, Mountain Lake, July 10, 1940. Pool, Cranberry Bog, Little Meadows, July 12, 1941.

Amblystegium serpens tenue (Schrad.) B. & S. On tree base, Hogskin Creek, Mountain Lake, July 4, 1941.

Hygrohypnum ochraceum (Turn.) Loeske. Little Stony Creek at West Virginia road, near Biological Station, Aug. 17, 1941.

Heterophyllum Haldanianum (Grev.) Kindb. On log, woods, Little Meadows, June 30, 1941.

Sematophyllum carolinianum var. *admixtum* (Sull.) Grout. On stone near Biological Station, July 21, 1942. (Coll. by Miss L. B. Henderson.)

Plagiothecium denticulatum subsp. *laetum* Bry. Eur. Humus, Pond Drain, Mountain Lake, July 22, 1941.

Leskeaceae

Anomodon viticulosus (Hedw.) Hook. & Taylor. Fairly common on shaded limestone rocks.

Fabroniaceae

Fabronia ciliaris (Brid.) Brid. On limestone rock, vertical damp cliff, large sinkhole on the Newport-Pembroke highway near Hoge's Store, Ag. 25, 1941.

HOLLINS COLLEGE VIRGINIA, and
THE MOUNTAIN LAKE BIOLOGICAL STATION OF
THE UNIVERSITY OF VIRGINIA.

NOTE ON FISSIDENS JAPONICUS

H. N. DIXON

Fissidens japonicus was described by Dozy & Molkenboer in Plantae Junghuhnianae, p. 313 (1851–55), and later in the Bryologia javanica, I, 9 (1855), based on a plant of unknown origin in Junghuhn's herbarium, and on a specimen collected by Siebold in Japan.

F. filicinus Doz. & Molk. was published in Musc. Frondos. Novae Spec. ex Archip. Indico et Japonia (1844).

F. nobilis Griff. was described by Griffith (Notulae, Part II, 427) in 1849, founded on a plant from Mumbree, Khasia Hills, Assam.

In the Bryologia javanica the authors repeat the original description of *F. japonicus* almost verbatim, with one or two verbal alterations. There too they repeat the distinctions they find between *F. japonicus* and *F. filicinus* (of which the description is also repeated) in practically the same terms.

It seems pertinent to ask why the description of *F. japonicus* was included in the Bryologia javanica, as it was obviously based on Siebold's japanese plant. The answer is that it was also found in Junghuhn's herbarium of Javan and Sumatran plants, and though no locality was given the authors apparently assumed that its origin was one of those islands. Why then does Fleischer take no note of it? The name is not even mentioned in the Musci . . . von Buitenzorg.

The probability is that Siebold collected his plant, apparently in some quantity, in Japan, and sent it with a consignment of living plants to Holland. Samples of the *Fissidens* were probably distributed, some being sent to Herb. reg. Lugd. Bat., where they were found and published by Dozy & Molkenboer, and others to Junghuhn, who

placed them in his herbarium, unnamed, where they were afterwards found by Dozy and Molkenboer, but not recognized as Siebold's gathering, and assumed to be from Java or Sumatra. Fleischer probably recognized this, and omitted all reference to the species in his work.

Apart from the discussion, by the authors, mentioned above, no comparison has been made, so far as I am aware, between the species generally known as *F. nobilis*, and *F. japonicus*. Leaving Junghuhn's plant out of the question, it has been assumed that *F. japonicus* is confined to Japan and one or two coastal localities in Eastern China, while *F. nobilis* has an Indo-Malayan distribution. This would be sufficient to explain the absence of comparison between the two plants. But the presumed geographical disjunction is not a fact. Both plants have been recorded from coastal China. The distribution of *F. nobilis* has been greatly extended of late, and includes Hongkong, and Yunnan on the one hand—links between the Chinese and Siamese stations,—and New Guinea on the other. Moreover I recently received from Fiji, collected by Greenwood, a plant which I naturally referred to *F. japonicus*. This rather remarkable piece of geographical distribution, however, led me to a comparison of the two species in question, a comparison which it is rather surprising has not been generally made, considering that they are perhaps the two finest species of one of the most striking genera of mosses.

The result has been that after a careful examination of the two plants I have come to the conclusion that they cannot possibly be separated.

In comparing the specimens I have confined myself to plants on the one hand from Japan (as representing *F. japonicus*), and on the other from India and Malaya (as representing *F. nobilis*), as there has been no suggestion of their overlapping one another in these areas.

Taking the points of difference one by one as given in the Bry. jav., they may be tabulated thus:—

Fissidens japonicus.

(a) Stem more slender, taller.
(b) Leaves longer, narrower, more closely set, the base of each overlapping its neighbor.
(c) Nerve ceasing below apex, not confluent with the thickened margins.
(d) Vaginant lamina a little longer.

(e) Dorsal lamina hardly undulate at base.
(f) Apical serratures "grosse et remote eroso-denticulata; in *F. filicinus* grosse et inaequaliter dentato-serrata."
(g) Female flowers two or three times greater and more slender.

Taking these points in order:—
(a) Not borne out at all by my specimens.
(b) The longest *F. japonicus* leaves I have are 5 mm., and Siamese and Assamese specimens quite equal this, and are quite as broad.

As to the density of the leaf arrangement, a Japanese specimen (Sasaoka 6035), from Ryukyu, has as distant and narrow leaves as anything I have of *F. nobilis.*
(c) This is a very elusive character. The thickened border gradually disappears, often, towards the apex, and it is difficult to say where it actually disappears. I can find no constant correlation between these characters either in the Japanese or the Indian plants. It varies considerably in both; occasionally I find the nerve very distinctly excurrent and then clearly confluent with the border, but this is rare.
(d) I find no difference.
(e) The dorsal lamina in Japanese plants is often not at all undulate.
(f) Japanese specimens show much more variation in the serration, among themselves, than is figured for the two species in the Bryol. jav.
(g) I have not attempted to verify this. The difference might well be caused by a difference in the degree of development of the perichaetia.

I think there is no doubt whatever that we have to do with a single species. The following list of localities, or some of them, from which I know the plant will show that the distribution is in no way markedly discontinuous, and is perfectly consistent with a single species:— Ceylon; North India; Assam; Burma; Malay Peninsula; Siam; Yunnan; Hongkong; Sumatra; Java; Borneo; Celebes; Philippines; Japan; Eastern Coastal China; New Guinea; Fiji.

The discovery of the species in Fiji is surprising, but several species of mosses of Indo-Malayan distribution have lately been found in those Islands, e. g. *Dicranoloma Braunii, Braunfelsia scariosa, Arthrocormus Schimperi, Syrrhopodon Banksii, Meiothecium hamatum,*

Rhaphidostichum luxurians, Taxithelium Lindbergii, Microctenidium Leveilleanum.

The question next arises, what is the correct name for the species? The answer is, undoubtedly *F. filicinus* Doz. & Molk. Why this name has been dropped and *F. nobilis* Griff. taken its place seems inexplicable. Fleischer (Musci . . . von Buitenzorg, I, 56) was I believe the first to recognize the identity of *F. filicinus* and *F. nobilis*, and he makes the former a synonym of the latter, giving the Bryologia javanica as place of publication of *F. filicinus*, overlooking not only its earlier description in the Plantae Junghuhnianae (1851–55), but the original publication in Muscorum Frondosorum Nov. spec. ex Archip. Indico et Japonia (1844), reprinted in the same year in Ann. Sci. Nat., 3me Sér. tome 2, p. 304.

The synonymy must stand as follows:—

Fissidens filicinus Doz. & Molk. Musc. Frond. Nov. Spec. ex Archip. Indico et Japonia, 1844, p. 7.

Syn. *Fissidens nobilis* Griff., Notulae, Part II, p. 427 (1849).
Fissidens japonicus Doz. & Molk. in Junghuhn, Plantae Junghuhnianae, Fasc. I–IV, p. 313 (1851–55).

I have to thank Mr. A. Gepp for assistance as to the Bibliography of the plants.

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TAXONOMIC NOTES, III. FURTHER SYNONYMS OF HYMENOSTYLIUM CURVIROSTRUM

A. LEROY ANDREWS

Edmund Russow in connection with his magistral dissertation[1] at the University of Dorpat defended among other things the thesis: "Species-Consumenten schaden mehr als Species-Producenten," or in other words the makers of new species are less of a nuisance than reducers of species. I have no doubt he proved his contention, but he did not himself become an irresponsible creator of species, nor is there anything to show that he approved of irresponsibility in others. Everything depends upon the quality of the species. I am sure that the reduction of a bad species is at least more meritorious, even if

[1] Beiträge zur Kenntniss der Torfmoose. 1865.

more thankless, than the production of a bad new one and certainly at present accurate knowledge involves the reduction of many names to harmless synonymy.

Brotherus in his treatment of the mosses for the second edition of Engler and Prantl[2] listed 26 species of *Hymenostylium* and limited the distribution of *H. curvirostre*[3] to a portion of the northern hemisphere. Several additional species have been proposed by various bryologists since 1924. Mr. H. N. Dixon in his "Studies in the Bryology of New Zealand"[4] had already recorded *H. curvirostre* as something new from the southern hemisphere and suspected that *H. longopulvinatum* Dus. from Patagonia might be the same thing. This suspicion I confirmed[5] and raised the question of the identity of *H. stillicidiorum* of Mitten from the Andes of South America. Dixon agreed with me[6] that *H. stillicidiorum* is identical with *H. curvirostre* and in the same article also reduced *H. xanthocarpum* (Hook.) Brid. and *H. aurantiacum* Mitt. of the Himalayan region to *H. curvirostre*. With all respect for Dixon's detailed discussion of the last point I do not feel entirely prepared to confirm his reduction of *H. xanthocarpum*, which differs from the forms of *H. curvirostrum* with which I am familiar, and would again submit that the varied forms of the *Hymenostylium* complex in the mountains of Asia might profit from a careful revision based upon abundant material. Certainly no one would contest the specific validity of *H. inconspicuum* (Griff.) Mitt. from that region.[7] As to other regions and confining myself to the authentic material I have been able to see, I have long been convinced that *H. luzonense* Broth.

[2] Die nat. Pflanzenfam. (Ed. 2.) **10**: 257. 1924.

[3] As Ehrhardt (Beitr. **1**: 188. 1787) originally described the species as *Pottia curvirostra*, not *curvirostris*, the corresponding neuter form should be *curvirostrum*, not *curvirostre*, though either form of the adjective is linguistically possible. The *recurvirostrum* of Hedwig was a self-admitted mistake, unless I badly minunderstand his Latin. In 1789 (Descr. et Adumbr. **2**: 68) he used *Gymnostomum recurvirostrum* at the head of his text. However, he stated on page 69, with the help of a footnote, that the specific name, *curvirostrum*, on the plate (No. 24) was that of Ehrhardt, from whom his specimen came, and that the name in the text should then be changed accordingly (Cujus triviale omnino, ut in Tabula, *curvirostra*, audire debet). In the Spec. Musc. of 1801 (p. 33), published after Hedwig's death by Schwaegrichen, the name *recurvirostrum* was however copied, bolstered by an incorrect reference to Ehrhardt's name as *Pottia recurvirostra*. The retention of Hedwig's self-admitted mistake as it appears in Grout's work and other recent American literature seems then even under international rule dubious, or if by any chance regarded as legitimate, merely another sad commentary on the arbitrary fixing of 1801 as a starting point for nomenclature.

[4] P. 117. 1923.

[5] THE BRYOLOGIST **29**: 69. 1926.

[6] THE BRYOLOGIST **30**: 109. 1928.

[7] See Salmon, Journ. Linn. Soc. (Bot.) **34**: 450. 1900.

from the Philippine Islands should be reduced to *H. curvirostrum* and now note that Bartram in his recent treatment of the mosses of the islands in question has already done so, calling it an inconsequential variety[8] while at the same time admitting the presence of typical *H. curvirostrum* in the islands. As to Africa, specimens from Abyssinia in the Mitten herbarium, labeled *H. xanthocarpum* are evidently also *H. curvirostrum*. However, it is to the species of America, especially North America, that I have given particular attention.

Mitten included in his original description of *Weisia stillicidiorum*[9] besides two specimens from the Andes of South America, the first mentioned of which clearly constitutes the type, also one from Cuba, namely the No. 8 of Wright's *Cuban Mosses*, issued as *Gymnostomum rupestre* var., a specimen which has caused me considerable trouble and which I was long inclined to consider a separate West Indian species. Especially noteworthy to me seemed the fact that its stem-section is not triangular and shows a definite central strand, which is not the normal condition in *H. curvirostrum* and has even been regarded as one of the main characters separating the genus *Hymenostylium* from *Gymnostomum*. However, it seems that not even this character is one that is stable even within the species.[10] Recognition of the lack of stability of this diagnostic character led both Loeske and Hilpert to favor the reuniting of *Hymenostylium* with *Gymnostomum* and this has been carried out by Grout.[11] In other fairly numerous West Indian specimens of *Hymenostylium* examined I have not again encountered the central strand of stem and as Wright's specimen does not differ in other respects from normal *H. curvirostrum*, I have felt obliged to consider it an aberrant specimen in this one particular rather than an isolated representative of a separate species. Not all of its stems show the central strand. Brotherus included four other species of *Hymenostylium* from the West Indies, all of them original creations of Carl Müller, namely: *H. crustaceum* (C. M.) Broth., *H. glaucum* (C. M.) Broth., *H. nanangium* (C. M.) Broth. and *H. Eggersii* (C. M.) Broth. After careful and repeated examina-

[8] Mosses of the Philippines, p. 107. 1939.

[9] Journ. Linn. Soc. (Bot.) 12: 134. 1869.

[10] Cf. especially Hilpert's Studies in the *Trichostomaceae*, Bot. Centralblatt, Beiheft 50^2: 587f., 651ff. 1933 and also Loeske, Zur Morphologie und Systematik der Laubmoose 78. 1910 and in his notes in Weigel's "Herbarium" Nr. 61: 121. 1922.

[11] Moss Flora of North America North of Mexico 1: 159. 1938. My use of *Hymenostylium* is not to be understood as disagreement with Grout on this point; I have as yet no settled conviction as to whether one or two genera are represented.

tion of these through many years on type material at the New York Botanical Garden and that kindly furnished me by Dr. Reimers from the C. Müller Herbarium in Berlin-Dahlem I am obliged to conclude that all are synonyms of *H. curvirostrum*. In justice to Brotherus it should be said that he merely lists the names without indicating a difference by key and that his is the credit for recognizing that all belong in *Hymenostylium*, while C. Müller had placed them in diverse genera: *H. crustaceum* as *Trichostomum*, *H. glaucum* and *H. nanangium* as *Pottia*, *H. Eggersii* as *Zygodon*. The glaucous color effect, not infrequent in West Indian specimens, which accounts for the name *glaucum*, has nothing to do with the plants themselves, being due in part to the white, limy substratum, supplemented in the type specimen by a filamentous growth, presumably algal.

Whatever opinion one may have as to the generic distinction between *Hymenostylium* and *Gymnostomum*, they have often enough been confused and not all the confusion is yet liquidated. Renauld and Cardot even began their European moss-exsiccati[12] with a specimen labeled *Gymnostomum rupestre* forma *elata*, which is very clearly *Hymenostylium curvirostrum*, at any rate in my set. The *Gymnostomum incurvans* Schimp. of Mexico, about which I will express no opinion at present, has by Brotherus[13] been impartially included in both genera. *Gymnostomum orizabanum* Schimp. and *G. uvidum* Card., both listed by Brotherus from Mexico, are to be added to the synonyms of *H. curvirostrum*.

The genera treated by Brotherus as *Molendoa* and *Anoectangium* are badly in need of revision and thorough study and are not entirely free from the possibility of confusion with *Gymnostomum* or *Hymenostylium*. However, the only case involving *H. curvirostrum* which I can definitely list after considerable study of a good deal of material is the one referred to by Grout[14] collected by Brother Arsène Brouard near Puebla, Mexico, and named by Thériot *Anoectangium compactum* Schwaegr.[15] The latter species is hardly to be expected as far south as Mexico and my specimen, labeled in Thériot's hand, is clearly *Hymenostylium curvirostrum*.

Hymenostylium guatemalense from Central America is an herbarium name of Brotherus, not published so far as I am aware. Clearly, it is

[12] *Musci europaei exsiccati* No. 1.
[13] Op. cit. pp. 256 and 257.
[14] Moss Flora of N. Amer. North of Mex. 1: 149. 1938.
[15] Reported in Smithsonian Miscellaneous Collections Vol. 85, No. 4, p. 4. 1931.

to be added to the synonymy of *H. curvirostrum*. *H. platyphyllum* (Kindb.) Broth. I had already[16] reduced to the species generally known as *Didymodon tophaceus*.

The principal result of the above considerations is the reduction of the 11 species of *Hymenostylium* assigned by Brotherus to North and South America by 7 species,[17] together with the further reduction of an herbarium name of Brotherus and the reduction to *H. curvirostrum* of 2 species placed by Brotherus in *Gymnostomum*. *H. curvirostrum* appears to be well distributed through the world where calcareous rock is available as a substratum, achieving its greatest variation in the mountains of Asia, where at least *H. inconspicuum* (Griff.) Mitt. is a distinct, but probably derivative species.[18]

ITHACA, NEW YORK.

LICHENS OF CRATER LAKE NATIONAL PARK

FRANK P. SIPE

The lichens listed in this paper were collected during several short expeditions around the rim of Crater Lake. The list represents only the beginning of a reasonably complete account of the striking lichen flora of the park area.

Crater Lake National Park is situated on the crest of the Cascade Mountains in Oregon. The lake itself is surrounded by steep slopes and cliffs. At many places the steeper cliffs are well covered with crustose lichens. The gentler slopes may be made up of disintegrating rock fragments, pumice, or fine ash. Some of these slopes have been invaded by trees, shrubs, and other vegetation. Thus there is quite a variety of environmental conditions, depending on the nature of the substratum, and exposure to sun and moisture.

The outer walls of the lake rim are much more gentle, sloping away as stony or soil-covered meadows and forested areas. Here one also

[16] THE BRYOLOGIST 25: 100. 1923.

[17] *H. contextum* Herz. and *H. longirostre* (Kunz.) Broth. I have not seen.

[18] Out of embattled Germany has just come to my notice a study on East Asiatic *Potriaceae* by Pan-Chieh Chen (Hedwigia 80: 1–76. 1941). In it our species is treated as *Gymnostomum curvirostre* (p. 59; *G. recurvirostrum* in the table on p. 26). *H. xanthocarpum* is separated specifically (p. 60), but as a synonym under the later specific name *G. aurantiacum* (Mitt.) Par. I believe *H. aurantiacum* is rather *H. curvirostrum*, or at any rate not the same as *H. xanthocarpum*. This is even suggested by Chen's figures drawn from both types. Certainly *H. luzonense*, which he includes in its synonymy, is referable to *H. curvirostrum*, as stated above.

finds a great variation in environmental conditions; stony canyons and outcrops of rock, pumice flats, and sparsely to deeply forested areas.

Two objectives were in mind when making these collections and notes: (1) to learn the lichen flora of a subalpine region of the Cascade Mountains, which might be assumed to represent the flora of the higher elevations of the Oregon Cascades; (2) to learn what lichens are particularly important in adding to the scenic interest of this area.

The part contributed by lichens, in giving a distinctive aspect to a recreation area, has been pointed out by Wheeler.[1] Although not as striking as some of the displays of wild flowers in this area, the lichens add more to the composite picture than is usually realized. Wild flowers come and go rather quickly, but the lichens are ever present, and "blossom" into showy displays with every shower. Especially noteworthy are the following: *Evernia vulpina,* "elkhorn moss," very abundant and showy, with greenish-yellow tufts, on dead limbs, and on tree trunks above the snow line; *Alectoria jubata,* "hair lichen," dark brown to black hair-like masses hanging from most trees; *Acarospora oxytona,* which forms many conspicuous yellow patches on smooth cliffs; *Caloplaca elegans,* forming many small reddish-orange spots; *Gyrophora* sp., which may all be called "rock tripe" are small, dark brown, leathery lichens, mostly found on sheltered and under surfaces of rocks; *Parmelia pubescens,* made up of fine intertwining brown threads, forming felt-like layers over many large boulders around the rim; *Rhizocarpon geographicum,* "map lichen," which forms a thin bright yellow crust on many smooth rock surfaces.

The collections here listed were made mostly along the north rim, above and near Cleetwood Cove. The author acknowledges the invaluable assistance of Dr. Albert W. Herre, in determining some of the more difficult species.

ACAROSPORA FUSCATA (Schrad.) Arn. Common on loose pumice fragments in many places.

ACAROSPORA OXYTONA (Ach.) Mass. A bright lemon-yellow lichen, often covering extensive patches on smooth rock surfaces around the rim.

ACAROSPORA RUFESCENS (Sm.) Bausch. On exposed rocks along lake rim.

[1] Wheeler, L. C. Lichens of Point Lobos Reserve. THE BRYOLOGIST 41: 107–113. 1938.

ALECTORIA JUBATA (L.) Ach. Black hair-like strands, common on twigs and bark of conifers.

ALECTORIA FREMONTII Tuck. Similar in appearance to preceding species.

ALECTORIA OREGANA Nyl. In small dark brown to black bush-like tufts on conifers.

CALOPLACA ELEGANS (Link) T. Fries. A showy reddish-orange lichen often growing in conspicuous patches on rock surfaces around the rim.

CLADONIA FIMBRIATA (L.) E. Fries. On the ground, usually in sheltered areas.

DERMATOCARPON MINIATUM (L.) Mann. One of the rock tripes. Common on boulders and cliffs, especially the somewhat sheltered under surfaces.

EVERNIA VULPINA (L.) Ach. A showy greenish-yellow lichen, growing in much branched tufts on trunks and limbs of dead and living trees.

GYROPHORA DECUSSATA (Vill.) Zahlbr. The various species of GYROPHORA may be called rock tripes. The Crater Lake area is well supplied with this genus.

GYROPHORA EROSA (Weberi) Ach. On under and less exposed surfaces of rocks along rim.

GYROPHORA HYPERBOREA Ach. Sheltered places on rocks, rim area.

GYROPHORA TORREFACTA (Lightf.) Cromb.

GYROPHORA VELLEA (L.) Ach.

HAEMATOMA VENTOSUM (L.) Mass. On rock surfaces along rim area, among other lichens. When moist, the scarlet apothecia are colorful.

LECANORA CINEREA (L.) Röhling. Mazama Rock canyon, on cellular basalt.

LECANORA CINEREORUFESCENS (Ach.) Nyl. Fairly common on rocks along rim.

LECANORA COILOCARPA (Ach.) Nyl. On much weathered rock along north rim.

LECANORA POLYTROPA (Ehrh.) Rabh. On pumice fragments, along north rim.

LECANORA RUPICOLA (L.) Zahlbr. On weathered pitchstone rocks.

LECIDEA AURICULATA Th. Fr. var. DIDUCENS (Nyl.) Th. Fr. On loose rock fragments, stony area on slopes of Llao Rock.

LECIDEA CONTIGUA E. Fries. Shaded areas of smooth rock surfaces, Mazama Rock.

LECIDEA CASCADENSIS H. Magn. On exposed and weathered andesite rocks, Vidae Cliff.

LECIDEA FUSCOATRA (L.) Ach. Common on exposed rock surfaces, north rim.

LECIDEA GRANULOSA (Ehrht.) Ach. On rocks thinly covered with soil.

LECIDEA LACUS CRATERIS H. Magn. On much weathered dasite rock, north rim.

LECIDEA MACROCARPA (DC) Th. Fr. Smooth rock surfaces, Mazama Rock, covering large patches.

LECIDEA MELANCHEIMA Tuck. On bark of Shasta Fir.

LECIDEA PRINGLEI Tuck. Rather sheltered spots, Mazama Rock canyon.

LECIDEA PUMICICOLA H. Magn. On pumice fragments, northeast part of park area.

LECIDEA SANGUINEA (Krumph.) Mig. On weathered andesite, Vidae Cliff.

PARMELIA PUBESCENS (L.) Vainio. Very common, partly covering many large rocks with a black felt-like layer.

PARMELIA SULCATA Tayl. On bark of Hemlock and Shasta Fir.

RAMALINA FARINACEA (L.) Ach. Forms small grayish tufts on bark of trees or shrubs.

RHIZOCARPON GEOGRAPHICUM (L.) Lam. & DC. On smooth rock surfaces in many localities around the rim, making showy lemon-yellow patches similar to *Acarospora oxytona*.

SOLORINA CROCEA (L.) Ach. Growing over mosses, in sheltered and moist situations.

XYLOGRAPHA ABIETINA (Pers.) Zahlbr. On well-weathered log, in Hemlock forest.

UNIVERSITY OF OREGON
EUGENE, OREGON

MULTIPLE EGGS IN SYMPHYOGYNA

ARTHUR W. HAUPT

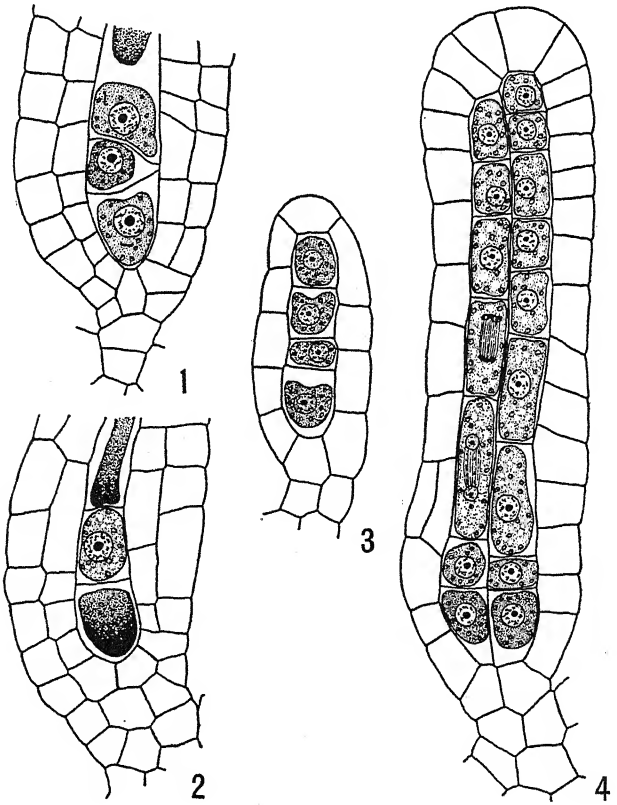
A study of various phases of the life history of *Symphyogyna brasiliensis* Nees, appearing elsewhere (Haupt, 1943), includes a detailed account of the development of the archegonium. It was based on material collected by the writer in Costa Rica during the summer of 1940 (Haupt, 1942). In connection with this study, several anomalous archegonia were found. Although such archegonia have not been previously reported in *Symphyogyna*, abnormal sex organs have been described in a number of other bryophytes. These furnish striking testimony (1) that phylogenetically both the neck canal cells and the ventral canal cell are eggs that have ceased to function as such and (2) that the antheridium and archegonium are homologous organs, the spermatogenous tissue of the former corresponding to the entire axial row of the latter. The present paper supplies additional evidence supporting the first of these theories. Evidence in support of the second has been presented in an earlier paper on *Preissia* (Haupt, 1926).

The archegonium represented by Fig. 1 displays at the base of the axial row three large cells of equal size and appearance. None has begun to disintegrate and two of them, the upper and lower ones, show the presence of a vermiform male nucleus within the cytoplasm. This indicates that all three cells are capable of fertilization and hence of functioning as eggs.

In a normal archegonium of *Symphyogyna* the ventral canal cell, just previous to its disintegration, is larger in relation to the size of the egg than in many other liverworts. This is a primitive feature characteristic of the Jungermanniales as a whole. Moreover, the ventral canal cell begins to break down before the neck canal cells show any evidence of disintegration. In the archegonium shown by Fig. 2 the ventral canal cell is as large as the egg and has not started to break down, while the egg and neck canal cells, on the other hand, are in an advanced state of disorganization. Here the ventral canal cell has become a functional egg, and although proof is lacking, doubtless would be capable of fertilization and of giving rise to an embryo.

The young archegonium represented by Fig. 3 has an axial row consisting of four cells essentially alike in size and state of development. Each has the appearance of a mature egg. If a precocious

division of the primary ventral cell has taken place, the lowest cell of the series corresponds to the egg of a normal archegonium, the cell directly above it to the ventral canal cell, and the two upper cells to neck canal cells. It seems more probable, however, that the lowest cell is the undivided primary ventral cell and that all three cells above it are neck canal cells. A similar archegonium has been reported by Florin (1922) in *Riccardia pinguis*, where other abnormal archegonia were also seen, such as the unusual persistence of the ventral canal cell and the occurrence in the venter of four morphologically equivalent nuclei derived by two successive divisions of the primary ventral cell.



FIGS. 1–4.—SYMPHYOGYNA BRASILIENSIS. Anomalous archegonia, × 400.

Fig. 4 shows a nearly mature archegonium with a double axial row. It is, of course, impossible to state, just when the doubling took place, although it probably occurred at a very early developmental stage. The cell at the base of each axial row is obviously an egg and the one immediately above, a ventral canal cell. The others are neck canal cells, the number of which, as in a normal archegonium of the same age, is still increasing. This is shown by the presence of mitotic figures. In *Porella platyphylla* Andrews (1908) found an archegonium with two perfectly formed eggs, two ventral canal cells, and two rows of neck canal cells. Although one row was somewhat shorter than the other, six cells were present in each.

The exceptional occurrence of multiple eggs in bryophytes may be regarded as a reversion to a condition in which more than one egg was regularly produced in an archegonium. A reversion to a still more primitive condition is seen in bryophytes where spermatogenous and oögenous cells sometimes arise in the same organ, indicating that the antheridium and archegonium have been derived from a common organ producing both sperms and eggs.

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POGONATUM LIEBMANNIANUM

T. C. FRYE AND ELIZABETH FERGUSON

POGONATUM LIEBMANNIANUM C. Muell. in Engler & Prantl Nat. Pfl.-Fam. 1 (3): 687, 1907.

Polytrichum (*Pogonatum*) *liebmannianum* C. Muell. Syn. Musc. Frond. 2: 563, 1851.

Plants in loose to dense sods, brown with green young parts; leafy shoots 7–12 mm. wide when moist. Stems erect, 1.5–8 cm. long, about

545 μ thick, mostly simple, often with a branch from the base, sometimes with 1–2 branches from below the female inflorescence, densely leafy on its upper ¼–⅔, scaly at base; in surface view the epidermal cells long, narrow, meeting end to end. Cross section of stem somewhat irregular in outline, not clearly triangular, showing rather indistinctly bounded zones; cortical zone grading into the intermediate zone, 3–5 cells thick, cell walls quite thick especially the outer wall of the epidermis; intermediate zone of rather large cells with moderately thick walls but thicker near inner boundary; central zone constituting the central axis separated from the intermediate zone by 1–2 layers of cells with thin walls, otherwise of small cells with thick walls. Rhizoids many below the surface of the ground and just above it, on some shoots to 2 cm. above the ground, those above the ground from the dorsal surface and margin of scales, hyaline, much branched, walls very thick when old. Leaves composed of sheath and blade, dark brown; apex acute, short, serrate, brown, composed of the excurrent vein; margin sharply serrate to sheath; vein sharply toothed on back near apex. Largest leaves up to 1.25 cm. long; blade up to 4 times as long as the sheath, lanceolate. Sheath of larger leaves ovate, up to 3 mm. long and 2.3 mm. wide, 1 cell thick exclusive of vein, somewhat undulate where narrowed to blade, entire or nearly so, much more translucent than the blade; sheaths about the same in size and form down the stem, the scales thus mostly or entirely sheath, yellowish. Blades of larger leaves narrowly triangular to lanceolate, up to 1.25 mm. wide at or near base, the adaxial surface almost covered with longitudinal lamellae, the blade 1 cell thick in the 2–4 rows of cells from margin to lamellae, mostly 2 cells thick from there to vein, margin plane to erect; teeth mostly composed of 1 cell with thick walls, sharply pointed; blades smaller down the stem until they wholly disappear near the base. Vein of sheath thin; of blade of larger leaves hidden by lamellae; in cross section showing a median band of large cells with thin walls, dorsal and ventral to this a band of small cells with very

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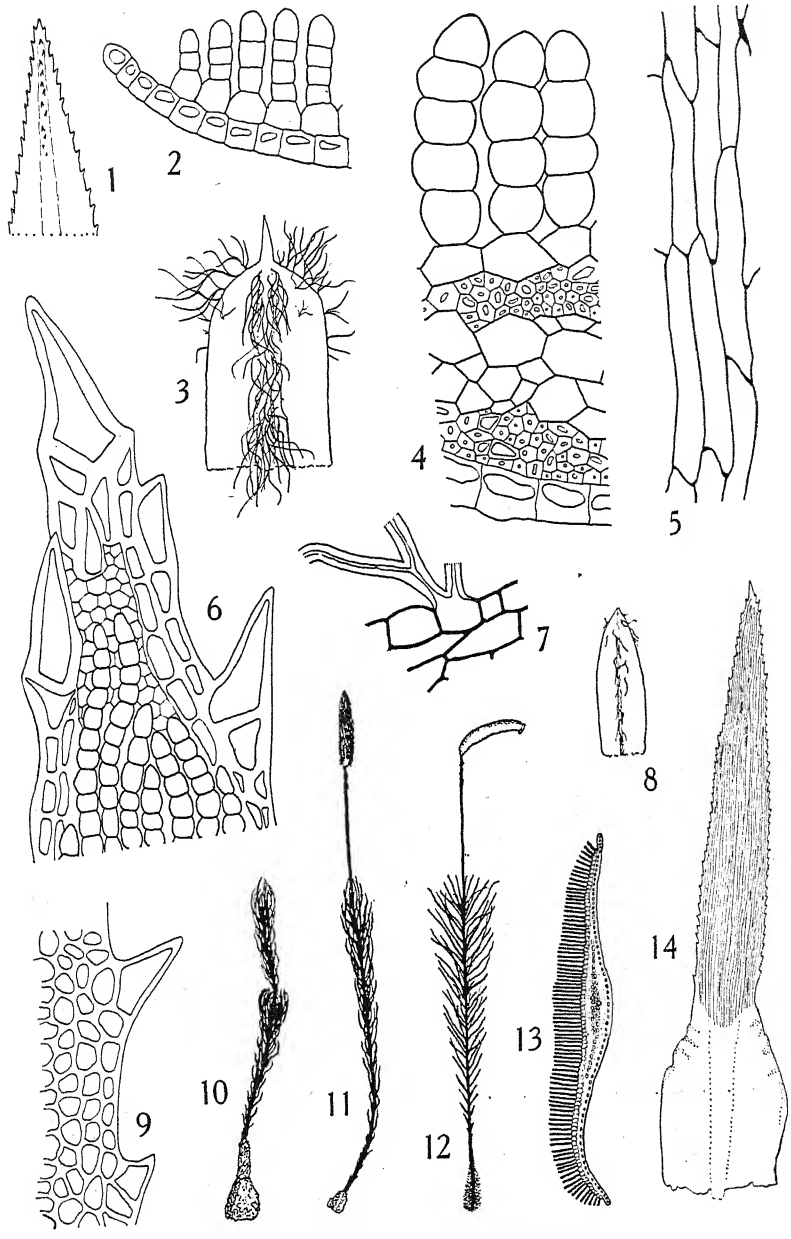
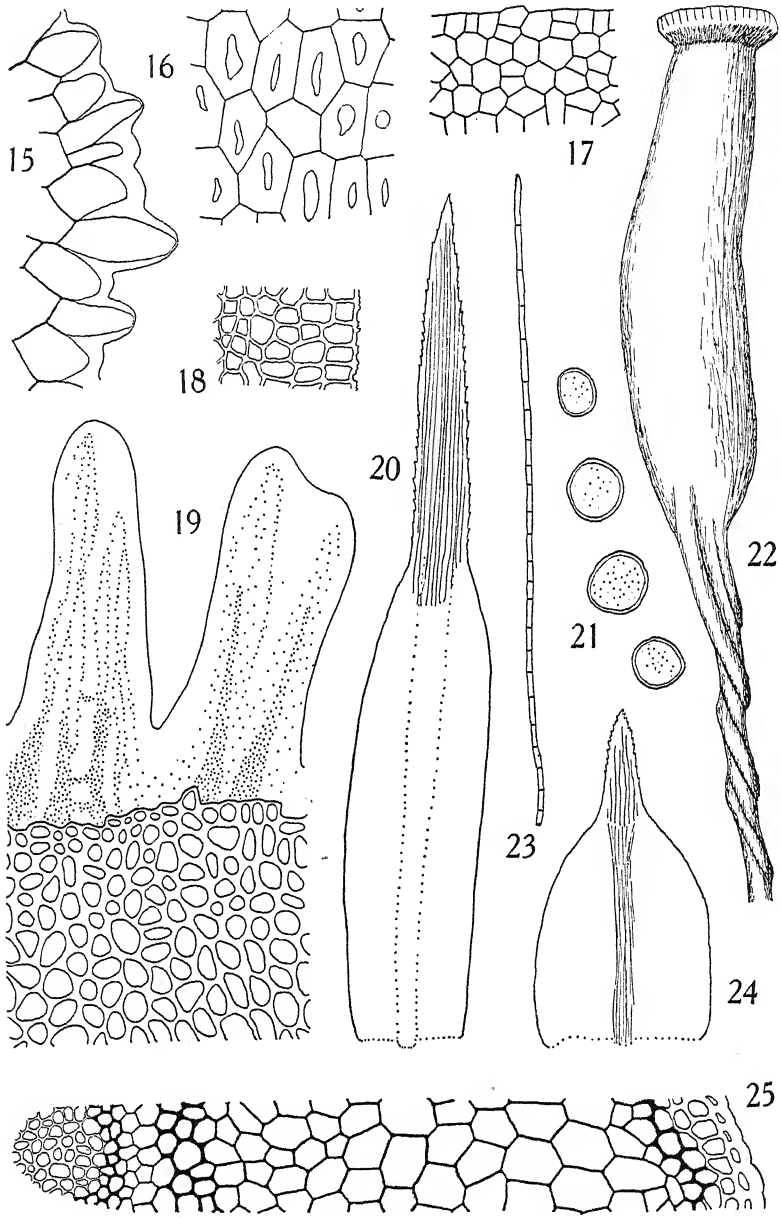
EXPLANATION OF FIGURES

FIGS. 1–14. *Pogonatum liebmannianum.* 1. Leaf apex, dorsal view, × 27. 2. Cross section of leaf margin, × 260. 3. Scale near base of stem, × 13. 4. Cross section of lamellae, × 560. 5. Median cells of leaf sheath, × 277. 6. Leaf apex, ventral view, × 210. 7. Rhizoid from margin of scale, × 246. 8. Basal scale of young shoot, × 13. 9. Margin of leaf blade, × 260. 10. Male plant, dry, × 1. 11. Female plant, dry, × 1. 12. Plant moist, × 1. 13. Cross section of blade, × 58. 14. Leaf, × 8.



POGONATUM LIEBMANNIANUM C. MUELL.



POGONATUM LIEBMANNIANUM C. MUELL.

thick walls, a dorsal epidermis of large cells with very thick walls, a ventral epidermis of large, thin walled cells under the lamellae. Cells of the median region of sheaths of larger leaves long and narrow, about 5–13 times as long as wide, those near base somewhat shorter, walls little thickened; those where sheath grades into blade shorter, rather suddenly grading into small cells wider than long and with very thick walls; cells along margin of blade isodiametric, with thick walls, dorsal and ventral epidermal cells between vein and unistratose margin like those of the vein. Lamellae on the blades of larger leaves up to 75, mostly 4–5 cells high but becoming lower toward margin and sheath of leaf, margin of lamellae entire or with occasional slightly projecting cells; cells in more or less definite longitudinal rows, walls thin, marginal cells like the others. Plants unisexual. Male plants like the female ones, often innovating through the cup. Bracts of the male involucral cup shorter than the largest leaves, inward with gradually shorter blades, so the innermost are chiefly sheath. Antheridia very numerous, clavate; paraphyses numerous, long, narrow, not inflated at tip. Female tip very much like a vegetative one. Inner perichaetial leaf longer than the longest normal leaves chiefly due to the much longer though slightly narrower sheath, lamellae few and low, a few of the upper leaves grading into the perichaetial one. Setae solitary, 17–23 mm. long, twisted to the left near sporangium, slightly verrucose through thickened spots on the cell walls, 550–570 μ thick, hollow when old, cortex 5–6 cells thick, in surface view the mature epidermal cells 15–21 times as long as wide; in cross section the cortical cells isodiametric with rather thick walls, the epidermal ones like the others. Calyptra densely hairy, tawny, reaching the base of the sporangium. Sporangium oblique to cernuous, about 7 mm. long, 1.2–1.7 mm. thick, nearly cylindric but slightly thicker in the basal half, suddenly contracted below the mouth, without constricted hypophysis, without stomates; epidermal cells of sporangium 1–2 times as long as wide, with thick walls, most cells projecting as a papilla;

EXPLANATION OF FIGURES

FIGS. 15–25. *Pogonatum liebmannianum.* 15. Cross section of epidermis of sporangium, × 260. 16. Surface view of epidermis of sporangium, × 246. 17. Side view of lamella, × 277. 18. Cross section of cortex of seta, × 210. 19. Teeth of peristome, × 133. 20. Inner perichaetial leaf, × 8. 21. Four spores, × 545. 22. Sporangium, × 10. 23. Antheridial paraphysis, × 47. 24. Inner antheridial bract, × 8. 25. Cross section of young stem, × 63.

the papillae with a thin apical spot, somewhat grouped in verrucae. Lid convex-conic, acuminate. Teeth 32, mostly rounded at tip, occasional ones showing tendency to divide. Spores 11–16 μ, smooth.—On damp shady bank. Type locality, Mount Orizaba, Mexico (F. M. Liebmann).

Examinations: *Guatemala.* Southeast of Palestina in Dept. Quezaltenango (Standley *84336*) 1941; mountains above San Juan Ostuncalco on road to Palestina in Dept. Quezaltenango (Standley *85259*, and *85265* sterile) 1941. Our packet of Standley's No. *84009* from Dept. Tetonicapan in 1941, distributed as *P. liebmannianum*, has the marginal cells of the lamellae in pairs and is not this species.

Range: Mexico; Guatemala.

All drawings were made from Standley's No. *84336*. The sporophytes were too old for detail of interior structure. No archegonia were seen. The origin of rhizoids from the stem was not established. Plates by courtesy of the University of Washington.

UNIVERSITY OF WASHINGTON
SEATTLE, WASHINGTON

THE 1942 FORAY

IRMA SCHNOOBERGER

The Sullivant Moss Society joined the Michigan Wild Flower Association for its annual Summer Foray, held August 24, 25, 26, 1942, at the University of Michigan Biological Station on Douglas Lake, Cheboygan County, Michigan. The members who had arrived Sunday evening, were assigned to various cabins by Frances Wynne, and spent the evening in renewing old or making new acquaintances.

Monday morning the station truck was waiting promptly at 9:00 a. m. and we were driven to the region known as "Carp Creek above the Iron Bridge." This is only a short distance, as the crow flies, from camp, but is a rather arduous walk and it was thought best to save time and energy for actual collecting. *Buxbaumia aphylla* (L.) Hedw. was found in abundance along the mossy bank above Carp Creek, *Climacium dendroides* (L.) Web. & Mohr, in good fruit, *Calliergon cordifolium* (Hedw.) Kindb., *Neckera pennata* (L.) Hedw. fruiting, *Heterophyllum Haldanianum* (Grev.) Kindb., *Plagiothecium turfaceum* (Lindb.) Lindb. fruiting, *Dicranum viride* Lindb., *Rhodobryum roseum* (Weis) Limpr. in fruit, *Sphagnum squarrosum* Crome, *Hypnum imponens* Hedw. fruiting, *Calypogeia neesiana* (Massal. et Carest.) K. Müll., *Sphagnum palustre* L., *Cratoneuron filicinum* (L.,

Hedw.) Roth, *Leptobryum pyriforme* (L.) Schimp. in fruit, *Bryum bimum* Schreb. in fruit, *Sphagnum capillaceum* (Weiss) Schrank, *Eurynchium strigosum* in fruit, *Mnium affine* Bland, *Meesia uliginosa* Hedw. fruiting, *Bryum uliginosum* (Brid.) Bry. eur. fruiting, and the find of the morning, in the wet swampy region beyond the wood limits near the mouth of Carp Creek where it empties into Burt Lake, *Cinclidium stygium* Sw., a new station.[1] Dr. Steere and Dr. Ikenberry were the lucky collectors. (I am sure we are all glad to know that Dr. Ikenberry is more successful in collecting mosses than at calling cows.)

After a fine lunch in the Station dining room we were again taken by truck to the Carp Creek Gorge. This gorge is the channel through which Carp Creek flows from High Springs, formed by the underground water from Douglas Lake, through a deep, heavily wooded ravine, to Burt Lake. Here was collected *Cirriphyllum piliferum* (Schreb.) Grout, *Bryhnia novae-anglia* (Sull. & Lesq.) Grout, *Mnium punctatum* (L.) Hedw., *Drepanocladus uncinatus* (Hedw.) Warnst., *Oncophorus wahlenbergii* Brid. fruiting, *Hypnum arcuatum* Lindb., *Chiloscyphus rivularis* (Schrad.) Loeske, *Hypnum crista-castrensis* L., Hedw., *Anomodon attenuatus* (Schreb., Hedw.) Hueben., *Fissidens osmundoides* Hedw., *Brachythecium rutabulum* (L.) Br. & Sch., and *Rhytidiadelphus triquetrus* (L., Hedw.) Warnst.

Tuesday morning we left the Station by truck at 8:30 headed for Cecil Bay. This is a very interesting locality. Beach pools, really bogs, line the bay a short distance back from the shore of Lake Michigan. Those who were on the 1938 Foray[2] will recall similar situations at Sauble and Oliphant Beaches on Lake Huron, in the Bruce Peninsula region. The low sand dunes are piled up parallel to the lake front and immediately back of them are narrow strips of bogs from which we collected *Drepanocladus revolvens* (Sw., C. Muell.) Warnst., *Scorpidium scorpioides* (L., Hedw.) Br. & Sch., *Cinclidium stygium* Sw., *Cratoneuron filicinum* (L., Hedw.) Roth., *Pohlia Wahlenbergii* (Web. & Mohr) A. L. Andrews, *Sphagnum squarrosum* Crome, fruiting, *Calliergon trifarium* (Web. & Mohr) Kindb. At the edge of the woods on the higher ground bordering these bogs we found *Tortella tortuosa* (L., Turn.) Limpr., *T. fragilis* (Hook. & Wils.) Limpr. *Aulacomnium palustre* (Web. & Mohr) Schwaegr. fruiting, *Meesia uliginosa* Hedw. fruiting, *Dicranum rugosum* (Hoffm.) Brid. fruiting, *Moerckia Flotowiana* (Gottsche) Schiffn., and, out along the beach under dry, rotting driftwood, quantities of *Catoscopium nigritum* Brid. in abundant fruit.

A short, but lovely drive along the Wilderness Park road brought us to Big Stone Bay, overlooking Lake Michigan. Here we ate a delicious lunch of bacon and egg sandwiches, tomatoes, pickles, coffee, and watermelon. Dr. Steere was the chief-cook and coffee maker, and we can recommend him highly in both capacities.

[1] Steere, W. C. 1942. Notes on Michigan Bryophytes. THE BRYOLOGIST 45: 165.

[2] Conard, Henry S. 1938. The Foray of 1938. THE BRYOLOGIST 41: 139.

The afternoon hike took us first along Big Stone Bay Creek where we collected *Didymodon recurvirostris* (Hedw.) Jenn. fruiting, *Fissidens cristatus* Wils. fruiting, *Myurella julacea* (Vill., Schwaegr.), *Entodon cladorrhizans* (Hedw.) C. Muell. This is an extremely interesting territory in that one finds here forms usually found only on calcareous rocks.[3] We then struck inland through Big Stone Bay Woods and collected *Grimmia apocarpa* (L.) Hedw. fruiting, *Hypnum reptile* Mx. fruiting, and *Frullania Bolanderi* Aust., an interesting *Frullania*, easy to determine, even in the field, as it is very dark against the trunk of the tree on which it is growing, the patches are circular, the inside older part of the patch dying off, and the erect to curved attenuate-appearing branches show up conspicuously.[4]

Returning to the station we were pleasantly surprised by being given an opportunity to take a boat trip around Douglas Lake. This was thoroughly enjoyed by all who went.

Wednesday morning we climbed into the smaller station truck, some of our group having left, and drove to Mud Lake Bog, about ten miles from the station, where many of the members were introduced to a quaking bog for the first time. After a brisk walk through Cedar woods we came to the bog which extends for some distance along Mud Lake. The chief collections made here were *Sphagnum Girgensohnii* Russow, *Calliergon cordifolium* (Hedw.) Kindb., *Sphagnum capillacium* var. *tenellum* (Schimp.) Andrews, *Sphagnum papillosum* Lindb., *Sphagnum cuspidatum* Ehrh., *Microlepidozia setacea* (Web.) Jørg. *Calypogeia sphagnicola* (Arn. & Pers.) Warnst. & Loeske, *Mylia anomala* (Hook.) S. F. Gray, *Cephalozia fluitans* (Nees) Spruce, *Dicranum Bergeri* Bland, *Calliergonella Schreberi* (Willd., Br. & Sch.) Grout and *Cephaloziella Hampeana* (Nees) Schiffn.

A large part of the credit for the success of this foray belongs to Dr. Steere, who planned the trips and pointed out the interesting species to be collected. Members in attendance were:

Marjorie Bingham
Dr. and Mrs. W. T. Darlington
Vikki Fox
Dr. and Mrs. G. J. Ikenberry
William Katz
James Kucyniak
Robert J. Lowry
Irma Schnooberger
Dr. and Mrs. W. C. Steere
Dr. Frances E. Wynne

FLINT NORTHERN HIGH SCHOOL
FLINT, MICHIGAN

[3] Steere, W. C. op. cit., p. 167
[4] Steere, W. C. op. cit., p. 156.

RANGE EXTENSIONS OF MOSSES IN WESTERN NORTH AMERICA

FRANCES E. WYNNE

In 1942 Otto Degener, assisted by LeRoy Peiler, collected mosses in western United States. Many of his collections represent range extensions in several states, namely California, Utah, Wyoming, South Dakota, and Colorado. None of these range extensions, however, are surprising or unexpected. The situation is, rather, that bryophytes have seldom been collected in the region so that their occurrence and range in the west is relatively unknown.

Interesting mosses were collected at the following localities:

Sequoia National Park, Tulare Co., Calif. June 5, 1942
St. George, Washington Co., Utah. June 20, 1942
Cedar Breaks National Monument, Iron Co., Utah. June 25–27, 1942
Zion Canyon, Washington Co., Utah. July 3, 1942
Evanston, Uinta Co., Wyoming. July 8, 1942
Rock Springs, Sweetwater Co., Wyoming. July 10, 1942
Rawlins, Carbon Co., Wyoming. July 13, 1942
Newcastle, Weston Co., Wyoming. July 16, 19, 1942
Custer, Custer Co., South Dakota. July 27, 29, 1942
Deadwood, Lawrence Co., South Dakota. Aug. 7, 1942
Idaho Springs, Clear Creek Co., Colorado. Aug. 13, 18, 1942

Listed below are species which, to the author's knowledge, have never before been collected in the respective states:

WYOMING

Dicranum rugosum
Didymodon trifarius
Desmatodon obtusifolius
Grimmia anodon
Grimmia plagiopodia
Grimmia pulvinata
Grimmia Raui
Hypnum reptile

UTAH

Grimmia laevigata
Mnium Blyttii
Leskea cyrtophylla

COLORADO

Rhytidiadelphus loreus

CALIFORNIA

Grimmia plagiopodia
Orthotrichum anomalum
Camptothecium nitens
Eurhynchium diversifolium

SOUTH DAKOTA

Encalypta rhabdocarpa
Grimmia pulvinata
Grimmia anodon
Rhytidium rugosum

Only recently has it been pointed out that the distribution of bryophytes parallels in general that of vascular plants. Steere (1937), Sharp (1939), and Schornherst (1943) have found interesting examples of this parallelism in Michigan, Tennessee, and northern Florida; further bryogeographical study will provide many more. When the ranges of many western mosses are mapped, familiar distributional patterns appear. *Grimmia Doniana*, *Timmia austriaca*, and *Rhytiadelphus loreus* are cordilleran species which occur also around the Great Lakes and/or New England and eastern Canada.

Steere (1937, *fig. 1*) has mapped the range of *Timmia austriaca* but he indicates no collections for South Dakota or Utah. Degener's collections from these states are not, however, outside of the northwestern range given in the most recent monograph of *Timmia* (Sayre 1935): "Greenland, Yukon Territory, Alberta, British Columbia, Vancouver Island; in the United States, Rocky Mountains south to New Mexico, east to Nebraska." Flowers (1929) has reported this species from Cache Co., Utah and T. C. Porter collected it in the Uinta Mountains, July 2, 1873.

Rhytidiadelphus loreus (*fig. 1*) is a western species which occurs in the east in Nova Scotia and Miquelon Island. *Grimmia Doniana* (*fig. 2*) is frequent in the Rocky Mountains and in New England and

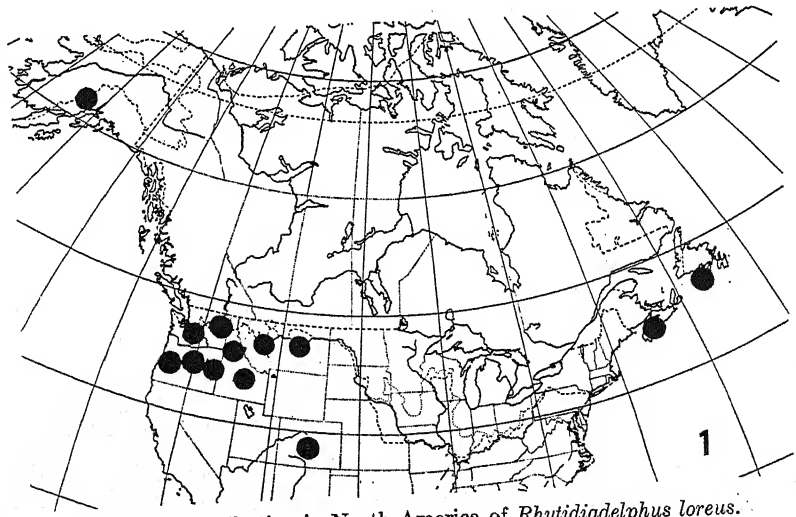


Fig. 1. Distribution in North America of *Rhytidiadelphus loreus*.

eastern Canada. It is represented in the Great Lakes by one collection from Ontario.

Degener's collections in the Black Hills of South Dakota at Deadwood and Custer represent eastern extensions for *Encalypta rhabdocarpa* and *Grimmia pulvinata*. Western plants are not uncommon in the Black Hills. Hayward (1928) in his analysis of the vascular plants of the Black Hills found that 25% of the species were characteristically western. The cordilleran *Grimmia anodon* and *Timmia austriaca* were also collected by Degener in the Black Hills.

Unless indicated otherwise, determinations are by the author. The nomenclature and arrangement of species follows Brotherus (1924–1925) in the second edition of Engler & Prantl's "Die Natürlichen Pflanzenfamilien."

DICRANACEAE

DICRANUM RUGOSUM (Hoffm.) Brid. WYOMING: Newcastle, July 19, 1942, *Degener & Peiler 17058*.

The only collections the author has seen from the Rocky Mountains are from Montana, Lake Athabasca, and British Columbia.

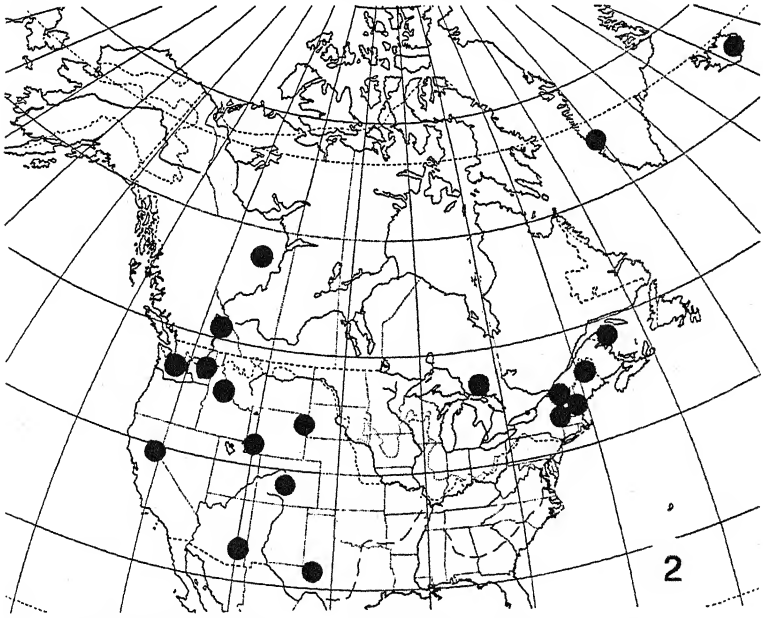


Fig. 2. Distribution in North America of *Grimmia Doniana*.

ENCALYPTACEAE

ENCALYPTA RHABDOCARPA Schwaegr. UTAH: Zion Canyon, July 3, 1942, *Degener & Peiler 16988*. WYOMING: Evanston, July 8, 1942, *Degener & Peiler 17035*. SOUTH DAKOTA: Deadwood, August 7, 1942, *Degener & Peiler 16976, 17034b*.

In Wyoming this species has been collected by Aven Nelson in Albany and Carbon Counties. It has been collected in northern Utah (Salt Lake Co.) by Flowers. It is frequent in the northwest.

ENCALYPTA VULGARIS var. MUTICA Brid. WYOMING: Rock Springs, July 10, 1942, *Degener & Peiler 16940*.

The only other collection of *Encalypta vulgaris* the author has seen from Wyoming was collected in the Laramie Mountains (*C. L. Porter 796*).

POTTIACEAE

DIDYMODON TRIFARIUS (Hedw.) Brid. WYOMING: Newcastle, July 16, 1942, *Degener & Peiler 16942*. (Det. by Dr. A. J. Grout.)

This species is reputedly more common in the west than in the east; however, there are no specimens from Wyoming in either the Farlow Herbarium or the New York Botanical Garden.

DESMATODON OBTUSIFOLIUS (Schwaegr.) Jur. WYOMING: Newcastle, July 16, 1942, *Degener & Peiler 17076*. SOUTH DAKOTA: Deadwood, August 7, 1942, *Degener & Peiler 16922*.

No collections from Wyoming were seen; T. A. Williams collected this species in Rapid City, S. D., in Aug. 1891.

GRIMMIACEAE

GRIMMIA ANODON Bry. Eur. SOUTH DAKOTA: Deadwood, August 7, 1942, *Degener & Peiler 16996*.

This species occurs in the west and extends east to the Dakotas. The author has seen no other plants from South Dakota; in North Dakota it was collected in the Kildeer Mts., July 26, 1929, *G. J. Ikenberry 39*.

GRIMMIA CALYPTRATA Hook. WYOMING: Newcastle, July 16, 1942, *Degener & Peiler 17057*.

To the author's knowledge this species has been collected once before in Wyoming (*Aven Nelson 2917*).

GRIMMIA DONIANA Sm. WYOMING: Evanston, July 8, 1942, *Degener & Peiler 16928*.

The author has seen no other collections from Wyoming; its distribution is plotted in figure 2.

GRIMMIA LAEVIGATA (Brid.) Brid. UTAH: St. George, June 20, 1942, *Degener 16952*.

No other specimens from Utah were seen.

GRIMMIA PLAGIOPODIA Hedw. CALIFORNIA: Sequoia National Park, June 5, 1942, *Degener & Peiler 17014b*. WYOMING: Rock Springs, July 10, 1942, *Degener & Peiler 17066, 17071;* Newcastle, July 16, 1942, *Degener & Peiler 16964*.

No plants of this species were seen from either state.

GRIMMIA PULVINATA (Hedw.) Sw. UTAH: St. George, June 20, 1942, *Degener & Peiler 16958a;* Zion Canyon, July 1942, *Degener 16981*. WYOMING: Rawlins, July 13, 1942, *Degener & Peiler 16923, 16925*. SOUTH DAKOTA: Custer, July 29, 1942, *Degener 17012*.

This species was reported from Utah in Lesquereux & James "Manual."

GRIMMIA RAUI Aust. WYOMING: Rawlins, July 13, 1942, *Degener & Peiler 16968*.

Although this species occurs in the northwest and extends east to Wisconsin, it has never before been reported from Wyoming.

BRYACEAE

BRYUM CIRRATUM Hppe. & Hornsch. UTAH: Zion Canyon, July 3, 1942, *Degener & Peiler 16900, 16911, 16983, 16984*.

This has been collected in northern Utah (Wasatch Mts., Utah Co.) by Flowers.

MNIUM BLYTTII Bry. Eur. UTAH: Cedar Breaks, June 27, 1943, *Degener 16956a*.

Flowers does not list this species from Utah.

TIMMIACEAE

TIMMIA AUSTRIACA Hedw. UTAH: Cedar Breaks, June 25, 1942, *Degener & Peiler 17053b;* Zion Canyon, July 3, 1942, *Degener & Peiler 16994*. SOUTH DAKOTA: Custer, July 29, 1942, *Degener 16966a;* Deadwood, August 7, 1942, *Degener & Peiler 17006*.

This species has been collected in northern Utah (Uinta Mts., July 2, 1873, *T. C. Porter* and Cache Co., *Seville Flowers 1039*); it has not been reported from southern Utah. In South Dakota it was collected at Spearfish in 1873 by M. A. Thompson.

ORTHOTRICHACEAE

ORTHOTRICHUM ANOMALUM Hedw. CALIFORNIA: Sequoia National Park, June 5, 1942, *Degener & Peiler 17014a*.

No specimens from California have been seen.

THUIDIACEAE

LESKEA CRYTOPHYLLA Kindb. UTAH: Cedar Breaks, June 25, 1942, *Degener 17018*.

This specimen was identified by Dr. A. J. Sharp who wrote, "It is an interesting record." This species has been collected in Ontario, Minnesota, Colorado, Idaho, and New Mexico. Not enough is known at present to understand its distribution although it may be one of the many western species which occur also around the Great Lakes.

PSEUDOLESKEA ATROVIRENS (Dicks.) Bry. Eur. CALIFORNIA: Sequoia National Park, June 5, 1942, *Degener & Peiler 16939, 16975b.*

To the author's knowledge, this species has not been collected in California since 1864–70 (Henry N. Bolander).

BRACHYTHECIACEAE

CAMPTOTHECIUM NITENS (Schreb.) Schimp. CALIFORNIA: Sequoia National Park, June 5, 1942, *Degener & Peiler 16953b.*

The author knows of no other collections from California.

EURHYNCHIUM DIVERSIFOLIUM (Schleich.) Bry. Eur. CALIFORNIA: Sequoia National Park, June 7, 1942, *Degener 16972.* UTAH: Cedar Breaks, June 25, 1942, *Degener & Peiler 16941.*

Flowers has collected this species in northern Utah (Cache Co.).

BRACHYTHECIUM ALBICANS (Hedw.) Bry. Eur. UTAH: Cedar Breaks, June 25, 1942, *Degener & Peiler 16913.* (Det. by Dr. A. J. Grout.)

Lesquereux & James reported a Watson collection from Utah.

HYPNACEAE

HYPNUM REPTILE Michx. WYOMING: Newcastle, July 19, 1942, *Degener & Peiler 16948, 17031.*

No other collections from Wyoming have been seen.

RHYTIDIACEAE

RHYTIDIUM RUGOSUM (Hedw.) Kindb. SOUTH DAKOTA: Custer, July 29, 1942, *Degener 16934, 17062b.*

Although this species occurs in boreal regions of North America it apparently has not been collected in South Dakota before.

RHYTIDIADELPHUS LOREUS (Hedw.) Warnst. COLORADO: Idaho Springs, August 13, 1942, *Degener & Peiler 16918.*

Figure 1 shows the distribution of this species; it has not been previously reported from Colorado.

THE NEW YORK BOTANICAL GARDEN
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